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ON REGULATOR WORK SCORES

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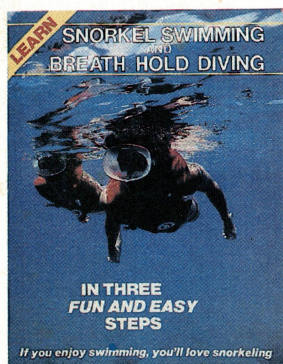
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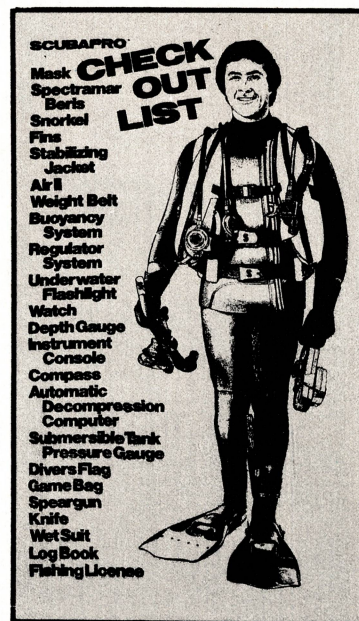
Anyway you slice it, the Scubapro Filet Knife will turn fishermen into chefs. Handsome simulated bone handle with an 8-inch razor-like blade will filet any catch. Includes sharpening stone and protective sheath.

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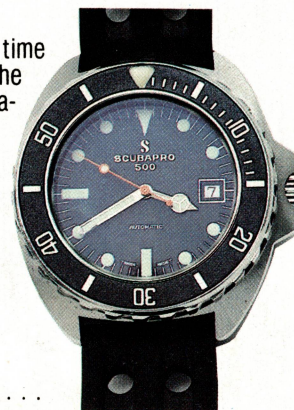


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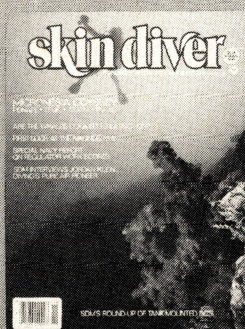


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skindiver

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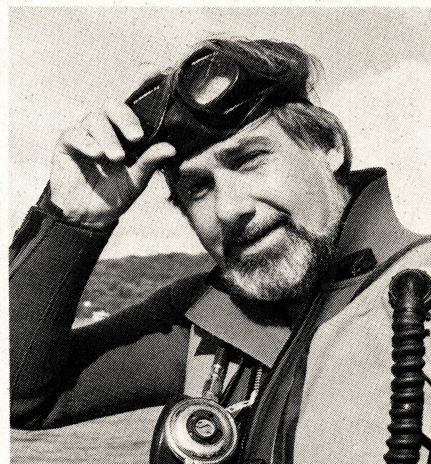
Exotic marine life, such as this raspberry colored soft coral, is a common sight along Palau's spectacular drop-offs. The photo was taken by Geri Murphy on Ngemelis Drop-off, Palau Lagoon.

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SDM Editorial

BY THE PUBLISHER

THE RESORT COURSE . . . DON'T SELL IT SHORT



In recent months we have received a number of complaints from readers condemning Caribbean dive resorts which offer three hour scuba classes in preparation for an ocean dive. In these readers' minds, it seems impossible that a novice can be ready for the ocean after a scant three hours' training, especially when compared to the 30 to 50 hour training course the fully certified scuba diver had to endure. These critical comments are a very natural and normal conclusion since the two kinds of training are worlds apart in concept, purpose, environment.

The crux of the misunderstanding about the short resort course appears to revolve around certification. Many readers just naturally assume the tourist receives a certification card after three hours of scuba training. This is untrue. The resort course is designed with an entirely different purpose in mind, and should never be compared or confused with a basic scuba training course.

The resort short course is nothing more than an introduction to scuba diving, designed specifically for the non-diving tourist who would like to try it while on vacation. The tourist seldom has enough time or inclination to enroll in a complete 40 hour course. Therefore, the resort instructor must come up with a condensed course of instruction which is convenient for the tourist while still being completely safe. The tourist/student is told exactly what he is getting, and is encouraged to enroll in a complete scuba training course when he returns home.

Who are these short course resort instructors? In many cases they are trained, certified instructors who have migrated to the tropical resort areas. Many possess extensive backgrounds in scuba training, having formerly conducted basic and advanced scuba courses in the states. They know the meaning of safe diving, safe scuba training, and certification. The era of the fast-talking beach boy with a rusty scuba tank is rapidly coming to an end,


and this new breed of well-qualified instructor has pretty well taken over scuba training in most resort locations.

The three hours of pool training offered in a resort program are considerably different from the pool training conducted in a regular course. Classes are usually quite small, often numbering two or three students. The training is far more personalized because of the low instructor/student ratio, and progress in learning is greatly accelerated. Pool exercises in physical conditioning are eliminated since there is no way of increasing a person's physical condition or stamina in one or two days. Many tourists learn the basics of scuba in one day and go diving in the ocean the next. The pool lectures and underwater sessions concentrate on the practical aspects and basic skills of scuba — proper leg kick, clearing the mask, buddy breathing, swimming without the mask, putting on and taking off the scuba gear, clearing the ears, and so on. Emphasis is placed on exhaling during ascent and the student is shown how to operate a BC. Lectures on dive physics, medicine, decompression tables, and other academic subjects are omitted since the student is being prepared for a shallow dive under strict supervision.

It is important to understand that there is little difference between the resort swimming pool class and the subsequent ocean dive. The water temperature is often the same, and in some cases the ocean is actually a little warmer than the pool. The same is true for the underwater visibility. In most tropical and sub-tropical resort areas, there is less than two feet of tide (being so close to the equator) and thus very little current. Most resort instructors select a quiet, protected area for the first ocean dive, with a coral reef in depths ranging from 5-25 feet. In other words, the first ocean experience is "bathtub diving," far different from the radical, and often traumatic, transition from pool to open water diving that most divers in the U.S. experience. Considering the gentle un-

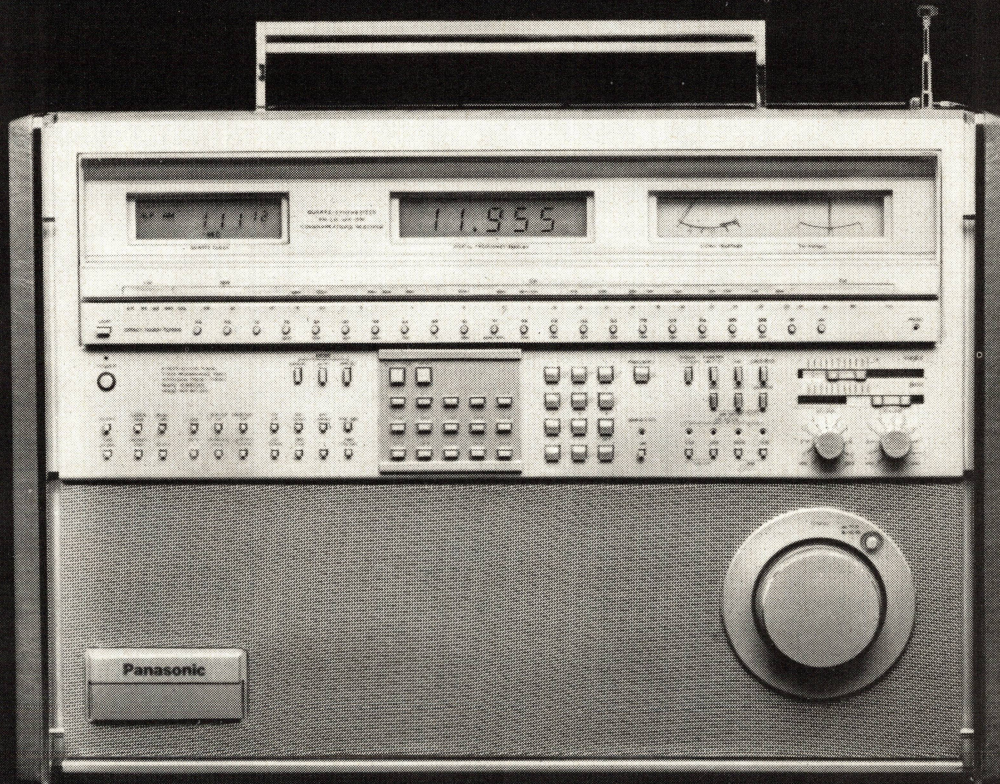
dersea environment into which the resort student will plunge, one can begin to understand how three hours of personalized instruction can serve as adequate preparation for an excursion.

The resort student's training continues throughout his ocean diving experiences even though he is now well beyond the three hours of pool training. Again, the training is personalized; no more than four novices to one instructor, and often only two per instructor. It is during these open water dives that the student gains much of his practical diver training — the kinds of skills which can only be discussed or simulated by long hours of pool training back home. The resort student learns how to get in and out of a dive boat, what not to touch underwater (fire coral), how it feels to equalize his ears on a 20 foot descent, and a dozen more skills which the 40 hour student back home can only imagine. By the end of his stay, the resort visitor has soaked up 6-12 hours of open water diving experience in addition to his initial three hour pool course. In some ways, the resort student is further ahead of the certified diver back home; but the resort student's knowledge and comprehension is limited to only one kind of dive experience. It is doubtful that he could handle the rigorous environments of the California kelp beds, Jersey's offshore wrecks, or the chilly depths of the Great Lakes. He cannot obtain air fills, rent scuba gear, or enjoy any of the privileges of a fully certified scuba diver. If a genuine interest has been sparked by this limited experience, then the resort student is advised to enroll in a complete course. In essence, the graduate of a short resort course is well qualified for only one thing — a dive in warm, clear waters under the close supervision of a certified resort instructor — and that is exactly what he set out to accomplish on his vacation.

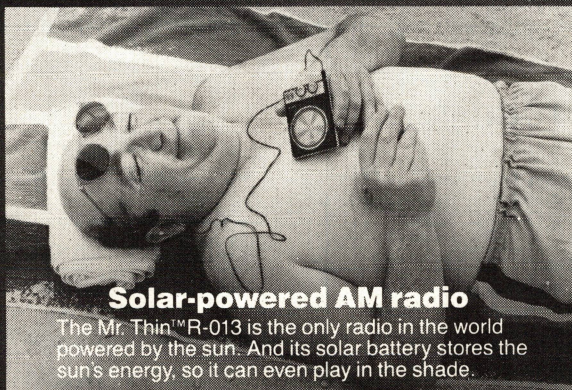
The resort short course can be one of the most beautiful ways of introducing a novice to the wonderful world of diving: so don't knock it before you've seen it. 

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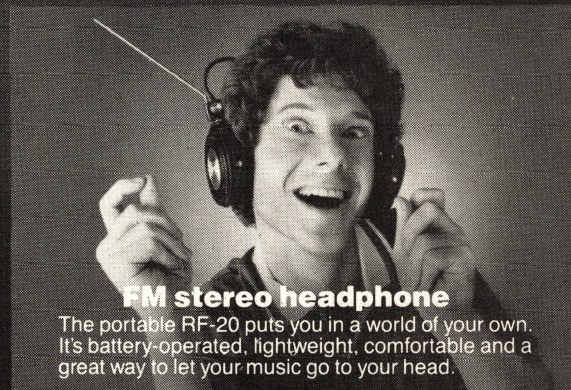


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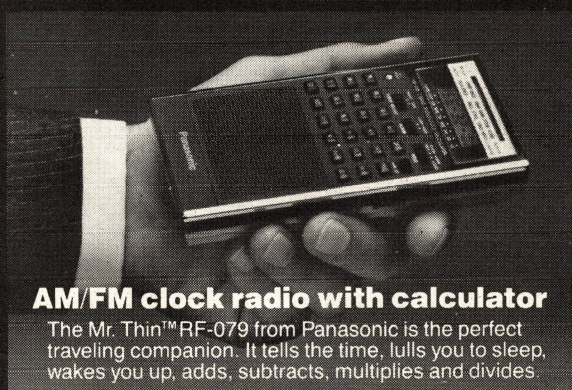
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Diver's Calendar

November 8 New Jersey Council of Diving Clubs Fourth Annual Symposium, Rutgers University, Voorhees Hall (Contact: Maria Levine, 70 Heather Lane, Princeton, NJ 08540)

November 15 Hawkeye Scuba Club exhibit, banquet, Central YMCA, Cedar Rapids, IA (Contact: Hawkeye Scuba Club, PO Box 8042, Cedar Rapids, IA 52408)

December 27-28 16th National Speleological Society Cave Diving Safety Workshop, Branford, Florida (Contact: Bill Fehring, 3508 Hollow Oak Place, Brandon, FL 33511)

January 17-20 1981 DEMA Trade Show, Las Vegas Hilton, Las Vegas, Nevada (Contact: Bob Grey, DEMA, P.O. Box 217, Tustin, CA 92680)

February 21 Sea State '81, Portland State University, Lincoln Hall, Portland, OR (Contact: Sea State '81, P.O. Box 7774, Tualatin, OR 97062)

February 28-March 1 7th Irish Open Festival of Underwater Photography, Limerick, Ireland (Contact: P. F. McCoole, Festival Director, Maricopa, Revington Park, Limerick, Ireland)

March 14 27th Annual Boston Sea Rover U/W Clinic, Boston University, John Hancock Hall, Boston, MA (Contact: Glen Reem, 30a Rockville Ave., Lexington, MA 02173)

IRISH U/W PHOTOGRAPHY FESTIVAL

The 7th annual Irish open festival of U/W photography will be held February 28-March 1, 1981 in Limerick, Ireland. The event is sponsored by the Limerick Sub-Aqua Club in conjunction with the Irish Underwater Council. Details and entry forms are available from P. F. McCoole, Festival Director, Maricopa, Revington, Limerick, Ireland.

DIVE MEDICINE/ SAN SALVADOR

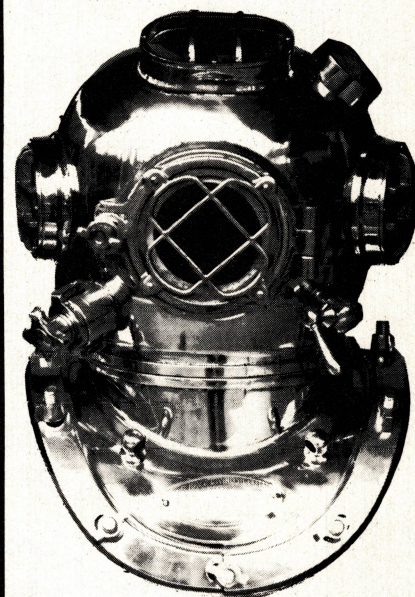
The Riding Rock Inn on San Salvador Island in the Bahamas will host a medical meeting for physicians February 28-March 7, 1981.

Diving Medicine In Depth includes lectures and seminars emphasizing the recognition and treatment of dive casualties and proper decompression procedures.

In addition to the academic portion, a complete dive program is included in the schedule. For information contact: Program Coordinator, Department 1250, Human Underwater Biology, P.O. Box 5893, San Antonio, TX 78201.

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SUBSEA INC. 10TH ANNIVERSARY

Subsea Products marks its tenth anniversary in the underwater photographic market by announcing a new consumer contest — The Subsea Choice. Subsea will produce a limited number of Special Edition Mark 100's, 150's and 225's in Special Edition colors. These colors will



Norine Rouse of Scuba Club of Palm Beach receives counter display from Larry Salvo.

be determined by the general diving public who fill out and return the Subsea Choice Special Editions entry form. On December 1, Subsea Products will pick one entry form. The individual who submitted it shall win a new rechargeable Mark 150 in the Special Edition colors and all associated bracketry.

Special Edition strobes, as well as the new rechargeable Mark 150, will not be available until January 1. For more information write Subsea Products Inc., 1006 West 15th St., Riviera Beach, Florida 33404.

SCALLI RECEIVES AWARD

Frank Scalli, worldwide sales manager for U.S. Divers Company, has been awarded the Distinguished Service Award by the Cotting School for Handicapped Children. The award, honoring him for more than 20 years of support and dedication, was presented by superintendent William J. Carmichael. Cotting is the first private day school for physically handicapped children in the United States.

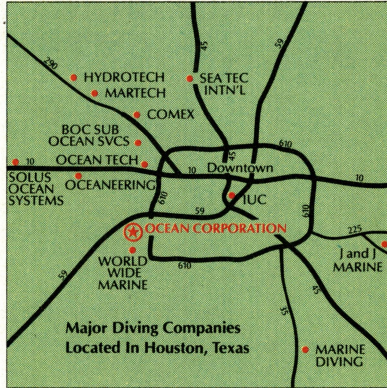
A scuba diver and instructor for almost 30 years, Scalli was the principal founder of Seamark, an annual benefit for the Cotting School, sponsored by skin and scuba divers of New England.

Seamark '80 will be held at the New England Aquarium in Boston on Saturday, November 1, and is expected to draw more than 1000 guests.

Why Houston?

BECAUSE

The Ocean Corporation is located in Houston and more commercial divers are hired in Houston than in any other place in the world. Twelve diving companies are located in Houston including three of the four largest in the U.S. Many others are located in the nearby New Orleans area. The demand for divers is so great in Houston that large locally based diving companies like Ocean Systems, Hydrotech Systems, Martech International and Sea Tech International have hired many of our students for part-time work while they were attending school. Over 90% of our recent graduates went to work for these and other local diving companies when they completed our program. Houston is the place where the action is...the commercial diving, offshore construction and oil industry capital of the world.



BECAUSE

The Ocean Corporation is a commercial diving company, not just a school. Our facilities, equipment and training aids are the best, and our diving systems are as up-to-date as possible... because much of the equipment is used by our diving operations division to perform actual diving contracts in the field. Ocean Corporation has successfully completed many underwater jobs for various industrial clients over the years... including specialized underwater inspections, maintenance and repair work. For example, we did the world's first commercial underwater repair job in a nuclear power plant. And most of our divers have been graduates of our own school.



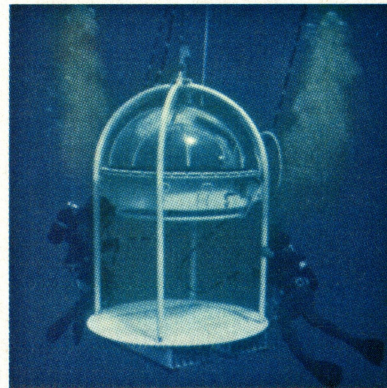
BECAUSE

The Ocean Corporation is a convenient and exciting place to go to school. Houston is one of the fastest-growing and most dynamic cities anywhere. It is a city of expansion, energy and youth (the average resident's age is in the mid-20's). Houston offers every conceivable kind of entertainment, from sports events, ultra-modern discos and open-air theater to rough-house local rodeos, chili cook-offs and the new Texas-size country-western dance clubs. Reasonably priced adult and singles apartments are readily available within walking distance of the school, and fast-food to luxury restaurants are nearby. The semi-tropical climate is wonderful, the sport diving is great and the folks are friendly.



BECAUSE

The Ocean Corporation management and instructor staff have long-term experience in the international offshore oilfield diving business. Retired ex-military divers and sport scuba divers don't run the school...commercial divers do. For example, the President of The Ocean Corporation, Larry



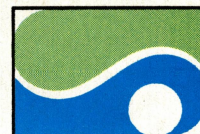
Cushman, was Vice President and Europe/Africa Area Manager for Ocean Systems, Inc. for three years...with responsibility for all North Sea diving and underwater construction operations. He also worked six years as a manager for Oceaneering International, Inc., another of the world's largest commercial diving contractors. Ocean Corporation managers and instructors know today's diving business...first-hand, from recent experience.



The Ocean Corporation

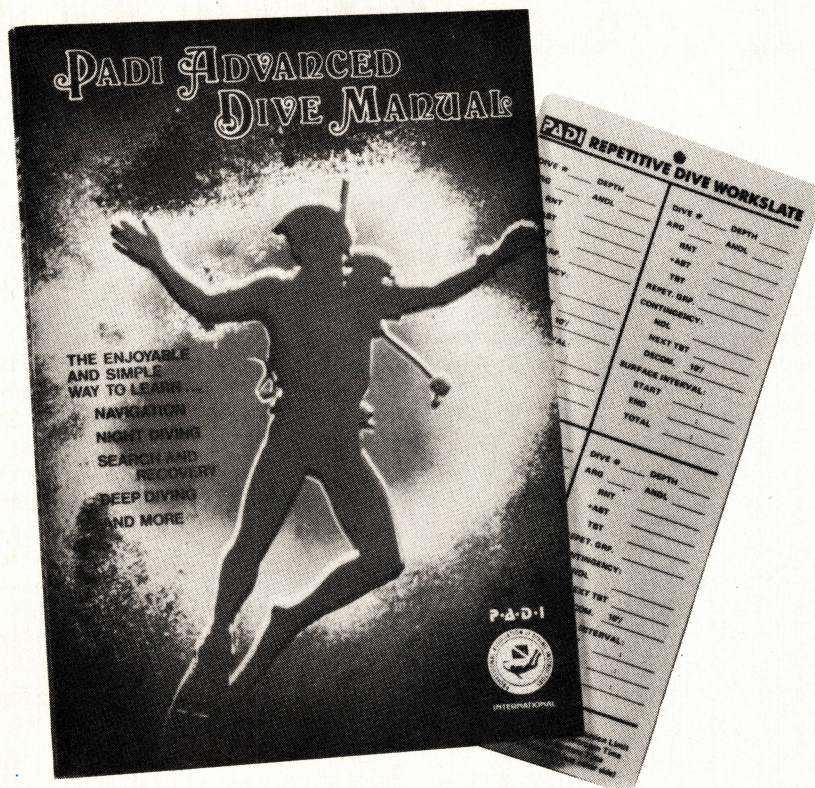
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EARLE TO RED SEA

La Mer Diving Seafari has organized a special Red Sea expedition with Dr. Sylvia Earle, chief scientist of the Ocean Trust Foundation. Departure is scheduled for November 15 from New York. This is the second in a series of unusual scientific and educational voyages aboard the beautiful 96 foot *Sun Boat*.

For information about scuba diving seafaris contact: La Mer Diving Seafari, Inc., 823 United Nations Plaza, New York, NY 10017. 🐠

DIT TRAINS OSHA INSPECTORS

The Divers Institute of Technology, Seattle, Washington has been awarded a contract to train OSHA field inspection personnel and other regulatory inspectors. A total of seven weeks of training will be involved with two separate courses.

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ICE DIVING

PADI International College announces its annual Ice Diving Specialty Programs to be held again this year in Baraboo, Wisconsin. Advanced divers can earn their ice diver certification; instructors can earn their instructor specialist certification. Commander James B. Williams, PADI International College's president, will also be on hand with a special sales promotion session for instructors and dive store owners for year-round promotions and winter travel. There are two programs again this year; December 26, 27, 28, and February 13, 14, 15. Write PADI International College, 1310 Rosecrans Street, San Diego, CA 92106. 🐠

SEARCH AND RECOVERY SEMINARS

The National YMCA Scuba Program will sponsor two scuba search & recovery training programs. The first, a basic training program, will be held February 9-13, 1981 in Key West, Florida. The seminar is designed to provide basic instruction for those involved in underwater recoveries.

The second, an advanced seminar, is scheduled for February 16-20, 1981 in Key West, Florida. Participants in this pilot program will be involved in a hands-on approach to advanced search & recovery techniques.

For information regarding either seminar, contact: The National YMCA Underwater Activities Center, P.O. Box 1547, Key West, FL 33040. 🐠

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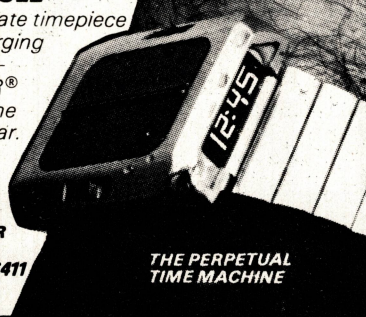


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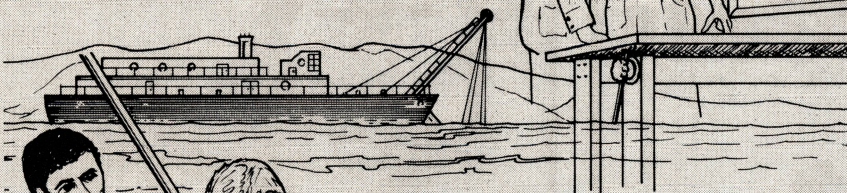
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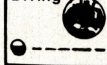
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CALIF. PUMPKIN CARVERS

The Second Annual U/W Pumpkin Carving Contest, sponsored by Cassotta Diving Inc. of Rocklin, California, was held October 25 at the Folsom Lake State Park and Recreation area. More than 50 buddy teams took diver's knife



in hand to carve their Halloween Jack-O-Lanterns while underwater. Winners vied for dive gear prizes. Cassotta's is at: 4930 Pacific St., Rocklin, CA 95677. ➤

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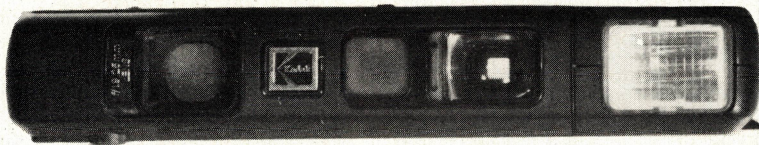
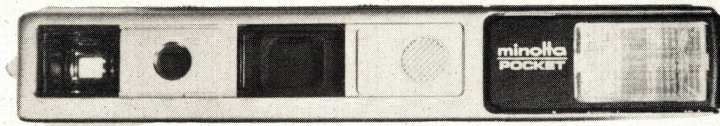
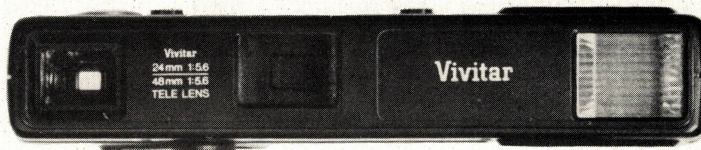
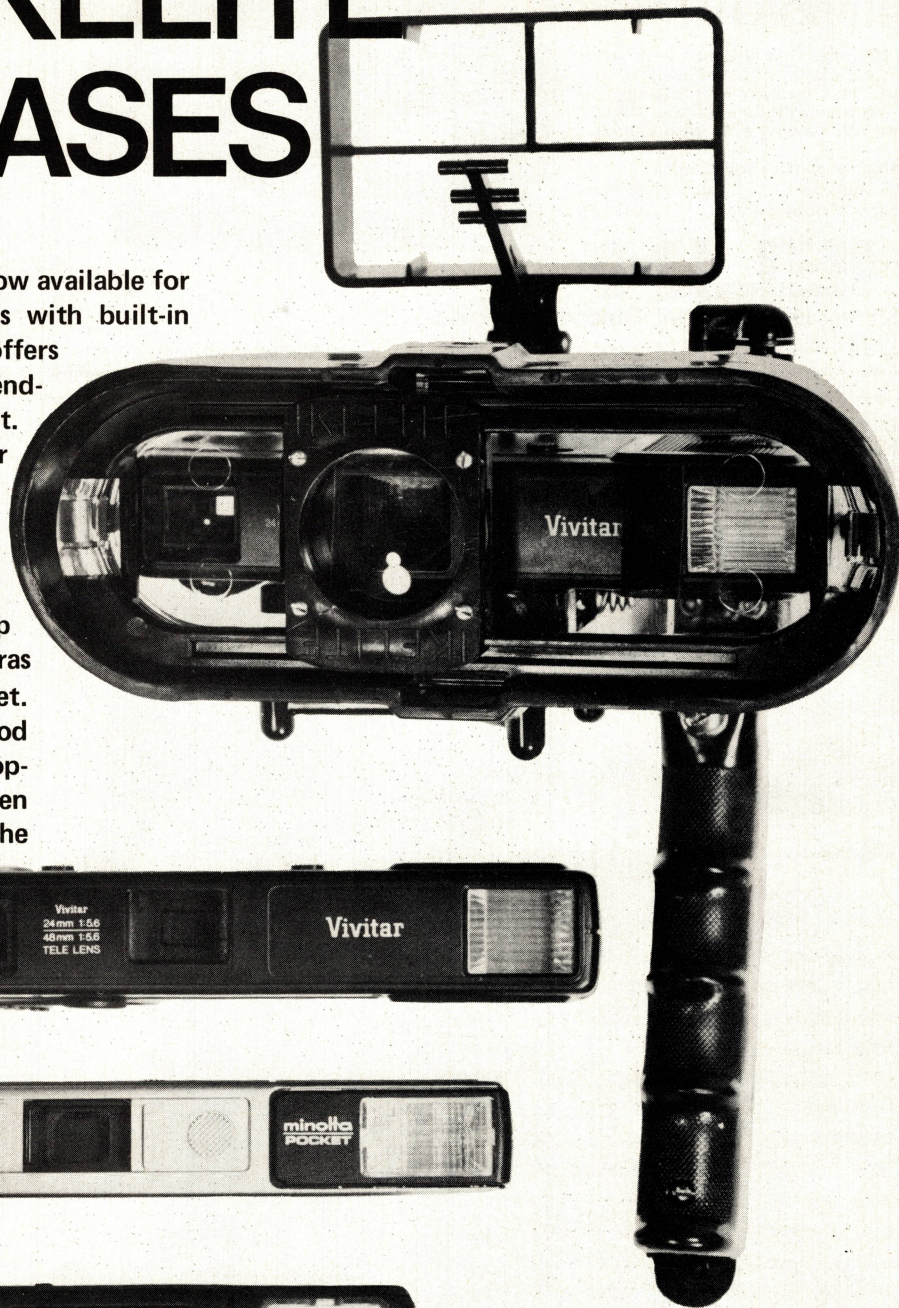
The Dive Shop of Hurffville, New Jersey will continue its holiday tradition with its second annual buffet and sale on Wednesday, December 3. The doors open at 10:00 am with a free buffet from 6:00 pm to midnight. The bar opens at 3:00 pm.



Norman and Diane Lichtman's Dive Shop has served South Jersey's dive community for the past ten years. They invite everyone to join in their Christmas Sale and Party for good deals, good food and a good time. For information, contact them at 228 Delsea Drive, Hurffville, NJ, (609) 589-2434. ➤

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The newer 110 camera models offer several features which have simplified their use underwater. The built-in electronic flash eliminates the cumbersome use of flash cubes. Some Vivitar models have motor winders; simply trip the shutter and the film is advanced automatically. These cameras have shown they can take incredibly good pictures underwater, almost automatically.

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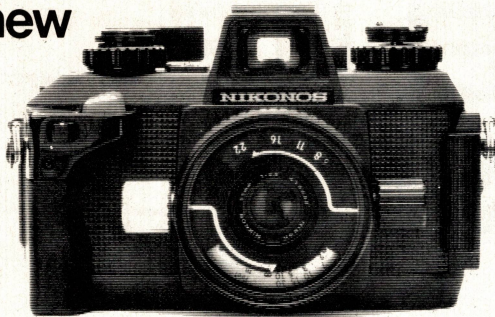
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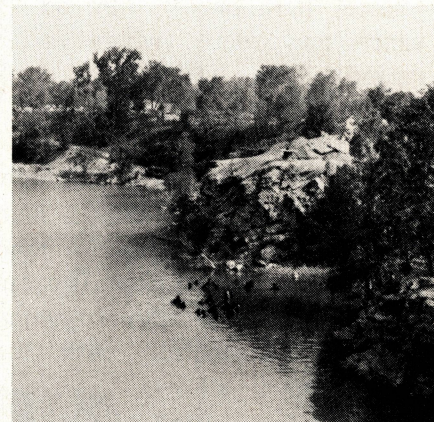
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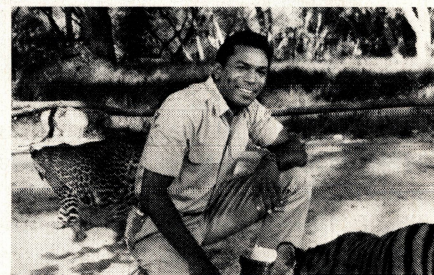
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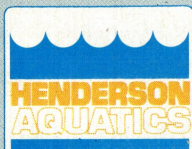
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Politics of Whaling

Are the ocean's most noble creatures doomed to extinction?

Text and Illustrations / Richard Ellis

As you read this, some of the largest animals that have ever lived on earth — larger than any dinosaurs — are swimming in the world's oceans. But we can draw little pleasure from this realization, because the great whales are now in grave danger of extinction, and it is likely that in our lifetimes — and almost certainly during the lifetimes of our children — some of these magnificent creatures will vanish forever from the Earth.

There are ten species of great whales; nine baleen species and a single species of toothed whale that is the largest carnivore that has ever lived. The baleen whales have a series of roughly triangular, flattened plates that hang from their upper jaws, and these plates (known as baleen), are fringed or frayed on the inner surface. It is from this apparatus that the whales derive the name *Mysticetes*, which can be translated as moustache whales. These whales take in a mouthful of crustaceans or small fishes, then force the water out through the baleen plates with their tongue, trapping perhaps millions of swimming crustaceans with each mouthful. The baleen whales are the blue, fin, sei, Bryde's, minke, gray, humpback, right and bowhead. The greatest of the toothed whales, *Odontocetes*, is the sperm whale. All ten species have had and have now a single enemy: man.

In only about 500 years — an eyewink in the history of the whales — man has

brought almost every one of these species to the brink of extinction. In the past it was possible to argue that whale products were essential adjuncts to civilization, and indeed they were. Before the discovery of petroleum in Pennsylvania in 1859, the primary source of oil for heating, lighting and lubrication was the whale. Also, the baleen plates, known as whalebone or simply bone, were employed wherever a strong, flexible material was required: umbrella ribs, buggy whips, ramrods, corset stays, skirt hoops. Around the turn of the 20th cen-

tury, spring steel replaced whalebone, and the bottom dropped out of the market. For reasons that were not clearly understood at the time, sperm whaling also dropped off markedly, and by 1900 most of the incentive for whaling had all but vanished.

It is a surprise, therefore, to learn that it was not the 19th century that saw the heyday of whaling, but the 20th. It was during the lifetime of many of those now reading this article that the industry had its most successful seasons, and not in the distant past, in the old days of "thar





ELLIS

Sperm Whale

she blows!" In the 1930's, the whaling nations were slaughtering every whale they could find in the Antarctic. In 1925 the stern slipway had been developed, enabling the huge factory ships to haul aboard and process whales at sea, and by the 30's the fleets were sent to the Southern Ocean every year. There the baleen whales would come to feed on krill, the shrimp-like crustaceans that appear in countless millions in the Antarctic summer (December to March). There were no restrictions on the number of whales that could be killed; only the clos-

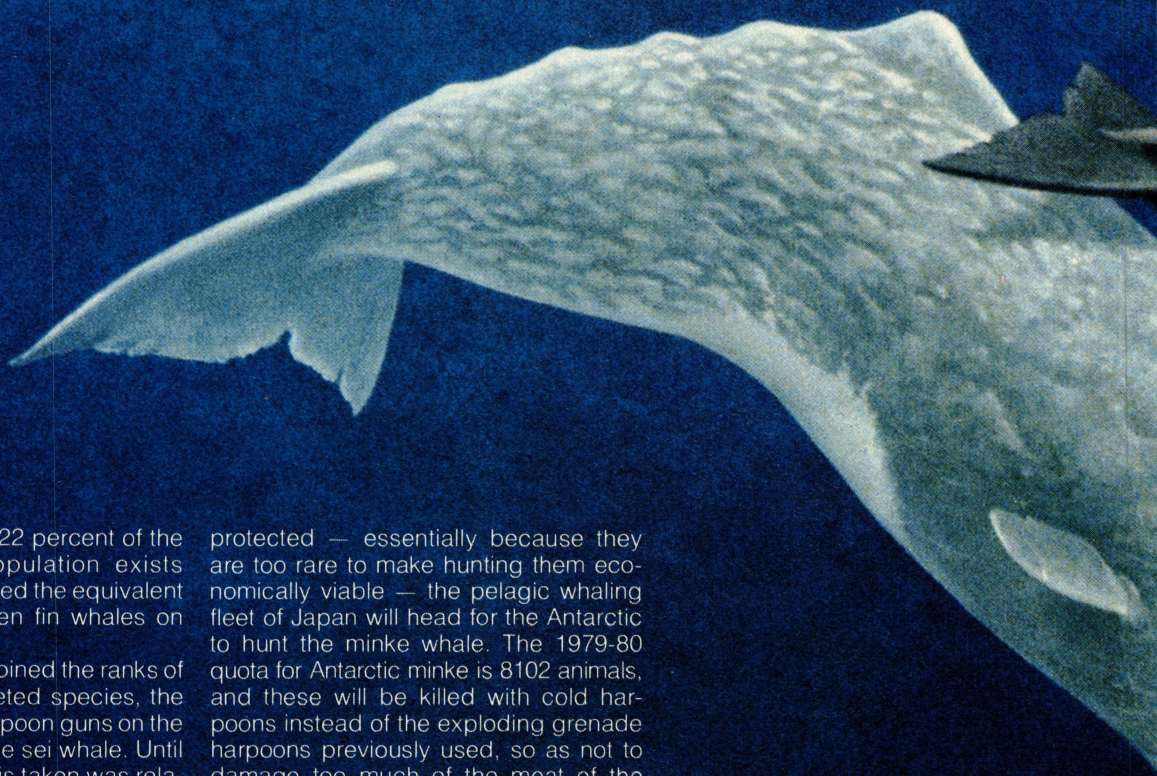
ing ice and the departure of the whales for their breeding grounds to the north signalled the end of the year's killing.

It soon became apparent that the whales were not an inexhaustible natural resource. (Of the great whales, the right and bowhead had already been so reduced in numbers that they were considered endangered, and the population of gray whales had been so reduced in the 19th century in the waters of Baja California that this species was considered extinct.) The 1946 International Whaling Commission met in London, and drafted a series of articles aimed at controlling the industry. From the first, the whaling nations were interested in preserving whales for their industry, and not for humane reasons. Those who would criticize the IWC for its failure to protect all whales forever must bear in mind that the original function of this organization was to ensure the perpetuation of the industry, and it only cared about the whales insofar as this concern did not interfere with the profits of the whalers.

Following that original convention, the IWC held annual meetings and failed ut-

terly to accomplish any of its stated goals. It condoned the slaughter of whales in such numbers that all those species which had not previously been endangered quickly fell into that category. The IWC placed restrictions on the killing of gray and right whales, "except when the meat and products are used exclusively for local consumption by the aborigines," and further mandated that calves and nursing mothers should not be killed. It was at the 1950 meeting that the insidious Blue Whale Unit was established, which effectively marked the blue whale for unprecedented slaughter. The Blue Whale Unit (abbreviated as BWU), was an index of productivity, and one BWU could be achieved by the killing of one blue, two fins, two and one-half humpbacks, or six sei whales. In the first year, the IWC set the BWU quota at 16,000 BWU's. Since the effort required to kill one blue whale was not appreciably greater than that required to kill a fin or a sei, the whalers would naturally seek out the blues, since they would return the most for the least effort. It was only a matter of time before the world population of blue whales was so depleted that the whalers would have to turn to other species. Even though it was painfully apparent that the Blue Whale Unit — and probably the blue whale as well — was almost obsolete, it took an incredible 22 years (1950-1972), before the BWU was abolished as the standard unit of measurement for the industry.

After the decimation of the blue whale, the whalers turned to the fin, the second largest of the baleen whales, and the second largest animal that ever lived. In 1931-32, when almost 30,000 blue whales were killed, only 10,017 fins were killed. In succeeding years, the number of fins killed rose as the number of blues dropped. From 1946 to 1964, a total of 432,660 fin whales were killed in the Antarctic, and another 61,704 in the rest of the world's oceans. In 18 years, one-half million fin whales had been killed. Reporting in the December 1976 National Geographic, the cetologist Victor Schef-



fer estimated that only 22 percent of the "pre-exploitation" population exists today — the whalers killed the equivalent of eight out of every ten fin whales on Earth.

When the fin whales joined the ranks of the commercially depleted species, the whalers turned their harpoon guns on the next largest species, the sei whale. Until 1964, the number of seis taken was relatively small; remember, it took six sei whales to equal the oil production of one blue whale. There were 8695 seis killed in that year, but by the next season the number had vaulted to 20,380. Like the Southern Hemisphere blue and fin whales, the seis came to the Antarctic to feed — and the whalers were waiting for them. By 1964, only three countries maintained pelagic whaling fleets: Japan, Norway, and the Soviet Union. All the other whaling nations had given up off-shore whaling and some of them maintained only shore stations. (In later years the shore stations would be closed, too; South Africa ceased whaling altogether in 1976, and Australia in 1977.) Bryde's whale, next to the sei in size, is the only rorqual in which the Southern Hemisphere population does not migrate to the Antarctic, so this species was spared during the intensive hunting in the southern polar waters.

For years the minke whale, smallest of the rorquals or groove-throated whales (at a maximum length of 30 feet), was considered too small for the whalers to bother with. It was hunted mostly by Canadians and Norwegians as an object of their small whale fisheries, in which pilot whales, killer whales, and other smaller cetaceans were taken in the North Atlantic. Now that all the other rorquals are

protected — essentially because they are too rare to make hunting them economically viable — the pelagic whaling fleet of Japan will head for the Antarctic to hunt the minke whale. The 1979-80 quota for Antarctic minke is 8102 animals, and these will be killed with cold harpoons instead of the exploding grenade harpoons previously used, so as not to damage too much of the meat of the eight to ten ton whales.

Because the sperm whale is unique in many respects, its whaling history is completely different from that of the baleen whales. It has teeth in its lower jaw only — these are the teeth that whalers used to carve scrimshaw — and its head contains a huge reservoir of waxy oil known as spermaceti. It was this oil that the Yankee whalers out of New Bedford and Nantucket sought as they pursued the sperm whale to the ends of the earth. The New Englanders did not really begin to hunt the sperm whale until about the middle of the 18th century, and this fishery flourished for about 100 years. During that period, fortunes were made and lost; sleepy New England villages such as New Bedford became prosperous cities; and *Moby Dick*, often considered the greatest novel ever written in America, was published. Complex economic factors, conjoined with an apparent lack of whales and the destruction of most of the whaling fleet during the Civil War, brought the fishery to a halt, and it appeared that the sperm whales had received a pardon since they had not been actively sought by the Antarctic fleets. Until about 1950, the whalers had concentrated on the baleen whales, but as their numbers decreased, the whalers once again looked for the unique for-

ward-angled spout of the sperm whale.

Male and female sperm whales are so different in size — males are almost twice the size of females — that the IWC set separate quotas for the sexes. Only the large bulls migrate to the high polar latitudes in both hemispheres, and therefore, the Antarctic whalers took a number of males every season. It was the North Pacific, however, that served as the primary hunting ground for the Japanese and Soviet sperm whalers. As with any other whale, the larger the animal caught, the greater the amount of product, in this case, oil and meat, and the bones (which were ground up for meal). Whalers sought the largest bulls, which can reach a length of 60 feet, and generally ignored the cows, which reach a maximum of about 40 feet. In the earliest IWC schedules the females were protected, under the assumption that their role in the perpetuation of the species was somehow more important than that of the males. (Males were also larger and



Male and female sperm whales

yielded more meat and oil, an observation that did not escape the participants in the IWC.) It has subsequently been suggested that because of the reproductive habits of these whales, in which a single bull services a harem of females, that the killing of the harem-masters might have been one of the major reasons for the 19th century population decline. In 1965, out of 25,728 sperm whales killed worldwide only 4323 were females, and in the same year in the Antarctic, 4532 sperm whales were killed, all males.

Problems soon began to appear in this fishery, but they were very different from those encountered in the baleen whale industry. In order to set quotas for the number of whales that could be killed

every year, the IWC had to have some idea of how many whales there were, and this turned out to be an almost impossible problem. At best it is a difficult proposition to count whales, but when the species is distributed over almost two-thirds of the Earth's surface — and highly migratory as well — the problem becomes almost insurmountable. Since 1968, the Scientific Committee of the IWC has been trying to figure out how many sperm whales there are in the world, with very little success. In 1976 the scientists were forced to admit that they had very little real knowledge of how many sperm whales there were, or for that matter, how to find out.

Despite their admitted ignorance, the Scientific Committee — under intense pressure from the sperm whaling nations — recommended even *higher* quotas for male and female sperm whales for the 1977-78 season: 13,037, as compared to 12,676 for the previous season. At a special Sperm Whale Meeting in 1977, the IWC Scientific Committee recommended a quota of 763 sperm whales for the

North Pacific, but in a move that stunned the world, the general meeting set the quota at 6444 whales, nearly *ten times* the number recommended by its own scientists. Reaction to this maneuver caused worldwide outcry, and directly and indirectly led to the application of substantial pressure on the IWC. At the 1978 meeting in London, no quotas at all for sperm whales were set, and confusion and indecision seemed to be the order of the day. At another special meeting the 1978 quotas were set at 3800 animals, a reduction of almost 40 percent from the previous year's calamitous 6444. It was now apparent that the IWC could no longer function as a gentlemen's club for the whaling nations, and it would have to be responsive to world opinion, especially as articulated by the environmental groups that had mounted massive save the whale campaigns.

The year between the 1978 and 1979 meetings was marked by even greater pressure on the whaling industry, and by 1979 the stage was set for substantial changes. In July, 1979 all factory ship whaling was banned in the North Pacific — effectively putting the Soviets out of the whaling business, and relegating the Japanese to the Antarctic where they can hunt only the minke whale — and the entire Indian Ocean was declared a whale sanctuary for ten years. (In what can only be interpreted as an indignant reaction to these restrictions, the Soviets took 201 North Pacific sperm whales anyway, and then sent their fleet to the Antarctic, where they killed 906 killer whales — animals that were not protected by any IWC rulings.) There is still an allowable quota of 2203 sperm whales that can be taken from shore stations, but this figure is a two-thirds reduction of the 1978-1979 quota.

There are a number of whaling ships that originate in countries that do not belong to the IWC, and therefore, to which no international laws apply. If a nation decides not to participate in the IWC, there is no way of regulating its whaling activities. These countries can kill any number, of any species, anywhere they want — except of course for whaling within the 200 mile limit of those nations that choose to protect their whales this way. The following countries belong to the IWC: Argentina, Australia, Brazil, Canada, Chile, Denmark, France, Iceland, Japan, South Korea, Mexico, Netherlands, New Zealand, Norway, Panama, Peru, Seychelles, South Africa, Spain, Sweden, U.S.S.R., Great Britain and the United States. In addition to those countries that conduct whaling activities but do not belong to the IWC, such as China and North

Korea, there are also nations that are not directly involved in whaling but allow the so-called pirate whalers to fly their flags, thereby disguising their true ownership and enabling them to operate outside international law.

In 1978, the *Tonna* (registry uncertain), was operating off the Canary Islands, and as a large fin whale was being winched aboard, the 450 ton cargo of frozen whale meat shifted, causing the *Tonna* to list badly. Unable to cut the whale loose, the whalers abandoned ship, leaving the *Tonna* with the sea pouring in her open hatches and portholes. Her captain, a Norwegian national named Kristof Vesperhein, went down with his ship (clutching a bottle of beer), but the remainder of the 42 man crew survived. This particular cargo never made it to Japan, the ultimate destination of most of the illegally collected whale products.

The *Sierra*, sister ship-in-crime of the *Tonna*, now lies on the bottom of Lisbon harbor after having been rammed by Paul Watson's *Sea Shepherd*. The *Sierra* was not sunk after the *Sea Shepherd*, a converted trawler and icebreaker, rammed her amidships and forward off Oporto, Portugal. The *Sierra* then put into Lisbon for repairs, and Watson was put into a Portuguese jail. He escaped and managed to scuttle the *Sea Shepherd* so she would not fall into the hands of the Portuguese authorities. In February, 1980 the *Sierra* once again set sail, heading for Madeira to resume her nefarious activities, but enroute, she was rocked by a mysterious explosion and sank.

With the *Tonna* and the *Sierra* gone, the pirate whaling fleet sustained a substantial loss. The whale meat was being shipped to Japan, and while this disclosure has embarrassed the Japanese, it has also stopped them from honoring long-term contracts with other outlaw whalers. Taiyo Fishery Company, the world's largest fishery company, still supports pirate whalers in Peru, Chile, and Panama. The outlaws subvert IWC regulations by marking the packages of

frozen meat Product of Spain. (Spain joined the IWC in 1979, and immediately filed an objection to the quota of 143 fin whales that was assigned to it. In the spring of 1980, two Spanish whaleships were mysteriously sunk in the harbor at Vigo.) Because the Japanese are willing to continue to create a market for the meat of illegally killed whales — of all species, including mother and baby humpbacks — the killing will continue.

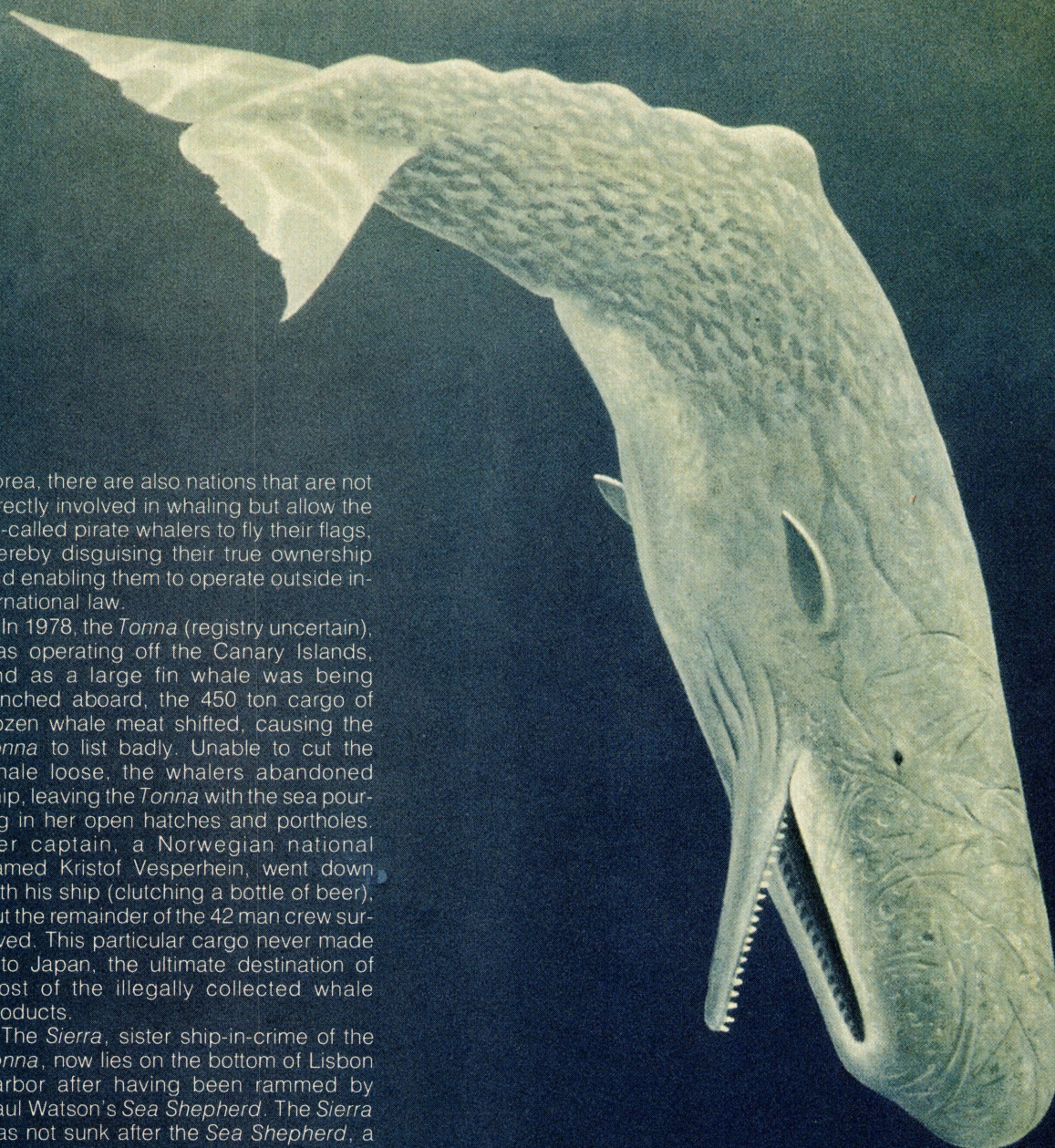
Even though neither species has been legally hunted for many years, the gray whale and the humpback are beset by problems, and although they occur in totally separate parts of the world, the problems are remarkably similar. The California gray whale is found exclusively in the coastal waters of the North American continent, although there was a population off the coast of Asia that was eliminated by Japanese and Korean whalers. The humpback is worldwide in distribu-

White sperm whale

tion, but it is scarce throughout its range. There are thought to be no more than 7000 humpbacks left, and about 15,000 gray whales.

Both species are the objects of whale-watching operations, and there is evidence that the presence of powerboats, divers, and other elements disturb the traditional migration and behavior patterns of the whales. The gray whales are closely watched — from shore, which does not disturb them, and from on the sea, which probably does — all the way from Alaska to the lagoons of Baja California, where they come every year to

(Continued on Page 80)





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Retouch Your Color Slides

A wintertime project
for turning your
throwaways
into winners

Text and Photography by
Jim and Cathy Church

The purpose of this article is to show you a simple method for retouching (painting) your color slides — a method for changing those throwaways into keepers. In Cathy's words, "It's so easy that even Jim can do it." We were introduced to slide painting by John (Swede) Wahlgren, a skilled U/W photographer, who showed us how to paint down overexposed highlights and add color to pale subjects. If this technique is so great, we wondered, why hasn't it been lauded in topside literature. Well,

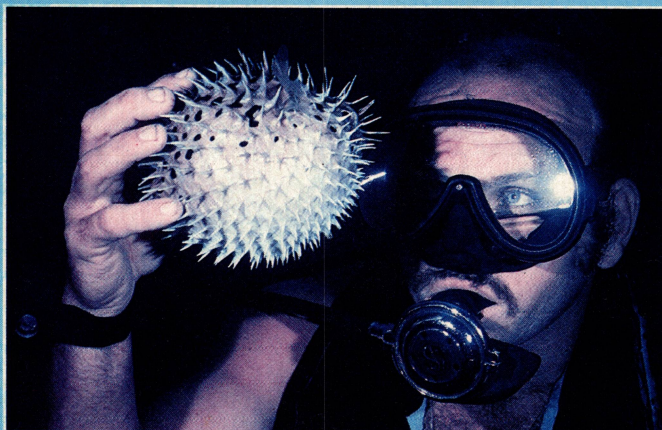
perhaps we missed it. And if you missed it too, this article is for you.

EQUIPMENT AND SUPPLIES

You will need all of these items to perform all of the techniques presented in this article: 1) A lightbox. This is simply a box with one or more light bulbs inside and a translucent, white top. Lightboxes are available at camera stores, or you can make your own. For best results, the slides should lie on a flat viewing surface that is strong enough to support the

weight of your hands and wrists. Flimsy lightboxes, with a slanted, stepped viewing surface, won't do the job. Bulbs with a color temperature of about 5500K (a color temperature which produces white light) are necessary if you are to see the true colors when viewing the slides. The color of standard lightbulbs is too yellow. Use plant growth bulbs, such as General Electric Croma 50 bulbs, or the Vita-Lite by Duro-Lite Lamps. The light must be white — some plant growth lights emit a purplish light.

Top right, a slide with an overexposed area. Left, the duplicate with overexposed area darkened, and orange added to the starfish.



Bottom left, the strobe light reflecting off the diver's faceplate causes strong glare. Right, the glare is reduced by painting.



2) A magnifier. A quality magnifier that stands upright, and which has an opening at one side so you can reach under the magnifier with an artist's paint brush, is best. A handheld magnifier is difficult to use — it requires a hand to hold it, and even the slightest movement creates eyestrain within a short time. We use the Edmund Scientific No. 42,769 6X Utility Magnifier (Edmund Scientific Co., Edscorp Bldg., Barrington, NJ 08007). Note: A more powerful magnifier may not show a large enough area of the slide.

3) One or more kits of Marshall's Photo Retouch Colors. These kits are available in three groups: Group 1 (the basic kit) provides you with the basic and primary colors. Groups 2 and 3 provide the more exotic colors. Each kit contains eight half-ounce bottles of dye, a paint brush and instructions. Although you can mix most of the colors you need with Group 1, we suggest that you splurge and get all three — they only cost \$7.55 each at this writing. The kits may be available at photo, art or hobby stores, and can be ordered directly from Marshall Mfg., 167 N. 9th St., Brooklyn, NY 11211.

4) A small transparent sheet of plastic (about six or eight inches square). This is your palette for mixing and diluting small amounts of different colored dyes.

5) Extra brushes. Although brushes are furnished with the kits, you may wish to purchase extra-fine brushes for detail work. We cut some brushes down to two or three bristles.

6) A smooth, clean sponge (available at art supply stores), or lintless blotter.

7) Two small containers of clean water. One is for moistening the sponge, the other is for rinsing dirty brushes.

8) Optional (but strongly recommended) — Kodak High Contrast Copy Film and B/W fixer. In normal room lighting, pull some film from the cassette, snip it off and gently submerge it in a bowl of fixer for the time specified on the package. Be careful not to damage the emulsion as you will be painting on it later. After fixing, rinse in room temperature tap water for about 20 minutes and hang the film up with a clothes pin and coat hanger in a dust-free area. The copy film will be clear and colorless. Note: Regular B/W film isn't suitable because it has a grayish base.

9) Optional — a home slide duplicating system, E-6 color slide home processing kit and plastic slide mounts.

THE BASIC METHODS

There are three ways to retouch a color slide. 1) Applying the transparent dye directly to the emulsion side of an original slide is the simplest method, but you don't dare make mistakes if the slide is valuable.

2) A safer method is to apply the dye to a duplicate slide.

3) A more complicated method —

which we believe is worth the extra effort and expense — is to sandwich the original slide with a piece of clear copy film in the same plastic slide mount. You then apply the dye to the emulsion side of the clear copy film, and not to the original slide. If you make mistakes, simply use a new piece of copy film. And because we don't know the long-term effects of age and projection on the painted emulsion, we make a duplicate slide of the original slide/copy film sandwich.

APPLYING THE DYES

Here are the basic steps for all of the techniques described in this article.

1) Place the slide (original, duplicate or sandwich) on the lightbox with the emulsion side facing upward. If an original slide and piece of copy film have been sandwiched, both emulsion sides should be facing the same direction (upward). To determine the emulsion side of regular film, look at the numbers and letters at the edges of the film (under the slide mount). When these read backward, the emulsion side is facing you. With the fixer-cleared copy film, which will show no letters or numbers, moisten the tips of your thumb and first finger. Pick up the copy film by a corner, and then slowly open your fingers. The side of the film which tends to stick to your thumb or finger is the emulsion side.

You can leave the slide in the mount if you are working with only a small area. But if you are painting a large area, or painting near the edges, remove the slide from the mount. Note: A sandwiched slide must usually be left in the mount to maintain alignment. The Marshall instructions say to tape the slide down to the lightbox, but we find it more convenient not to tape it. It is easier to paint if you can move the slide around to get the right brush angle. Be careful, however, not to use an oily fingertip on the fragile emulsion.

2) Use the sponge to moisten the emulsion with clean water — moisten the surrounding area as well as the area to be painted. If you are working directly on an original or duplicate slide, the emulsion will swell, darken and develop a yellowish tint. When it dries, it will return to normal. Learning to judge the effects of moistening and drying requires practice. Copy film, however, doesn't darken or take a color tint when wet.

3) Choose the colors needed, and dilute and mix them on the palette. Begin with shades a little lighter than the area to be painted, and work up to the darker shades.

4) Moisten the brush with dye from the palette, and brush it lightly along a clean section of palette to remove excess dye. Apply small amounts at a time, in layers, so you can control the spread of the dye. Caution: If you start painting with full-strength dyes on dry emulsion, you will

create streaks and irregular densities. By wetting the emulsion with water first, and then adding diluted dye a little at a time, you can blend the color into the emulsion smoothly. When working on a large light area, start in the surrounding dark area, and then work toward the light area.

CORRECTING FOR OVEREXPOSURE

For best results, the overexposed portion should be a relatively small area in a darker, properly exposed slide. As examples, think of a light-skinned diver's face or arm, a reflective fish, or a sandy foreground that was too close to your strobe.

The overexposed area should still show any necessary subject details. You can apply dye to darken the area, but you can't paint in details. Large, overexposed areas — without details — will simply take on the color of the dye. With a midwater background, however, lack of detail may not be important. But as long as the overexposed area has details — such as the diver's facial features within the mask — you'd be surprised how the slide can be improved by simply darkening the overexposed area with the appropriately colored dye.

If your slide has a blue tint, try mixing a touch of blue to the color you are working with. If you are painting down overexposed light skin, for example, add a touch of blue to the flesh-colored dye. This gives your subject a more natural underwater look — flesh tones that are no longer overexposed, but flesh tones which blend in with the other colors in the picture. This also applies to other color tints, such as green, etc.

It is usually easier to paint an overexposed area that is next to a dark area. The reason is simple: Should you accidentally paint past the edge of the overexposed area, it won't show. You can blend the dye from the light into the dark areas. In an upward silhouette through an overhead tunnel opening, for example, the ball of sun was overexposed and washed out part of the blue background. We simply painted the light portion of the tunnel opening with blue dye and added black dye to the edges of the tunnel. The result was a slide that appeared to be properly exposed, and you probably wouldn't detect the paint job unless you had been told. This particular slide could have been sandwiched with a piece of blue filter material, but the dyes give us a more variable range of colors and densities to work with.

CORRECTING COLORS

You can often change the tint and/or the intensity of a color. If your moray eel is too brownish, you can paint in a greenish tint. Or, you make your model's yellow strobe an even richer yellow with a touch of yellow dye. In one of our slide shows, a

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RETOUCH YOUR SLIDES

fish appears on the screen to the lyrics, "... and the red squirrel fish, with its big, enormous eyes." Actually, the fish was overexposed and its color slightly washed out. But — SHAZAM — we added a touch of red, and the viewers will never know.

REDUCING BACKSCATTER AND FLARE

Underwater slides taken with powerful strobe lighting are sometimes marred by backscatter. The strobe light strikes suspended particles in the water, and these illuminated particles show up as bright specks in the slide.

Bright specks on a black background — the problem you may have with close-ups and night photography — are the easiest to deal with. Simply use black dye to paint out the specks on the black background. But with lighter backgrounds, such as blue midwater, the specks can't be hidden. You can, however, reduce their intensity by applying a thin coat of diluted dye to the background area, and this may be enough to save the picture.

If the specks are between camera and subject, painting becomes much more difficult. You must mix the dyes to an exact color match with the subject immediately around the speck. And using a fine brush (with only a couple bristles), you must paint only the speck. If you paint beyond the edge of the speck, you get a dark border. This method can usually only be used with the larger specks. Again, you can't eliminate the speck completely, but you may be able to reduce its intensity and change its color tint.

Flare is another form of backscatter. Strobe light reflecting from bright areas of the subject — such as a regulator or the shiny scales of a barracuda — can reflect against particles surrounding that area. This produces a flare of light around that part of the subject. By matching the background color, you may be able to blend in dye until the flare has been reduced. Again, the picture won't be perfect — but it will be better.

REMOVING BACKGROUND SUBJECTS

This is virtually the same technique as painting out backscatter specks, but on a much larger scale. Imagine a stalk of fire coral, an out-of-focus fish or some other bright distraction in a dark, close-up background. Paint over the background subject with a dye mixed to darken the background. If the back-

ground is black, you can usually remove the unwanted subject. And with lighter backgrounds, you can tone it down so it is less distracting. Remember, that in a slide show — where slides aren't on the screen long enough for the audience to examine them critically — the darkened background subject may not be noticed as long as the main close-up subject is bright and powerful enough to hold the viewer's attention.

CONCLUSION

Keep the corrections subtle. The audience shouldn't be able to detect your painted slides in a slide show. The tendency is to overdo it at first, and this only draws attention to the poor paint job. Remember that you can't always completely hide a defect, but you can often significantly reduce it.

Slide painting techniques can also be used for special effects. There may be times when you want to change or add colors radically, times when it won't matter if the audience knows that colors have been changed. Some of the slides in our Truk Lagoon slide show, for example, were taken from wartime B/W prints. We painted in the fire and smoke of the explosions, and these slides blend into the show effectively. Try it, it's fun! 🐟

SCUBA DEATHS DROPPED IN 1977-1978

A dramatic drop in the number of U.S. sport diving fatalities occurred during 1977 and 1978, according to a team of University of Rhode Island researchers. In 1977, 102 deaths were recorded, 25 percent below the average of the previous three years. Fatalities increased slightly to 116 in 1978, 18 percent below the previous three years' average.

1977 had the lowest number of fatalities since 1970, when URI opened its National Underwater Accident Data Center to collect statistics and analyze the causes of deaths. Fatalities reached a high of 147 in 1976, a year in which scuba training activities reached a low in enrollment.

John J. McAniff, the URI dive safety officer who heads the project, attributes the increased safety record to better instruction and equipment. "Training agencies have improved their programs and are including more open water dives. There are more continuing education and specialty courses offered, which keeps beginning divers under supervision longer. Manufacturers have also made great advances in equipment design, such as with the buoyancy compensator vests," he explained. More detailed information on the dive fatalities is available in a report titled: *United States Underwater Diving Fatality Statistics 1977-1978*, which will be available later this year. Order it from Scuba Safety, P.O. Box 68, Kingston, RI 02881. 🐟

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An exclusive interview with

JORDAN KLEIN

Text and photography by Rick Frehsee

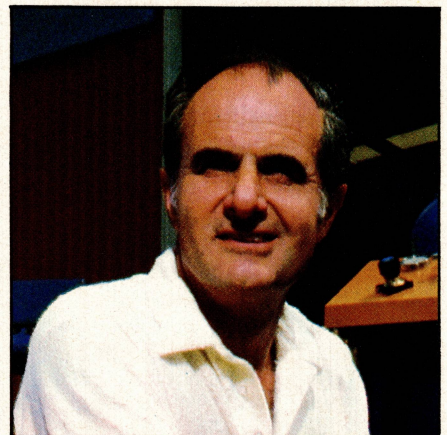
In 1956 when double hose regulators were in vogue and most skin divers were spearfishermen, the first Mako compressor was assembled in Miami, Florida. To trace the development of Mako is to trace the development of Jordan Klein, the man behind the technology. The same Jordan Klein who builds lavish underwater sets and designs the mechanical gadgetry for James Bond movie spectacles is also responsible for the Mako trademark. In the late 40's and early 50's Klein, as a dive charter captain, began to develop products for the sport. At first, he and Jerry Greenberg collaborated on simple cameras and housings for underwater photography. By about 1952 a series of Mako plastic underwater cameras had been developed and Klein had also realized that perhaps the weakest link in the dive industry was the availability of reliable air compressors.

As recent as the 1960's, diving was still in the dark ages of compressed air technology and Klein asserts that it was nothing short of a miracle that many hundreds of divers did not succumb to foul air. Perhaps the shallow depths protected the majority. In the 60's and 70's a handful of responsible dive shop owners, including Jordan Klein, began to realize the potential dangers as the numbers of divers increased rapidly. Fortunately this led to the scientific development of filtration and purification systems that would produce truly safe, nontoxic air.

Skin divers are attracted to shiny regulators, handsome watches and alloy scuba tanks. It's easy to forget that

the underwater world would still be an inaccessible frontier if it weren't for the availability of high quality compressed air. Pure air is as necessary to the scuba diver as gasoline is to the motorist. Almost every move forward in dive technology had to be paralleled by advances in the science and technology of compressed gases.

Ironically, there is no such thing as a compressor that produces air fit for human breathing alone. This process involves both filtration and purification. These terms have evolved to mean that filtration removes both moisture and particulates, while purification involves



Above, Jordan Klein; the founder of the Mako air compressor empire. Below, Jordan and two associates behind a fraction of the equipment manufactured at their Florida plant.



the chemical removal of all toxic properties such as carbon monoxide and carbon dioxide. Neither are simple tasks and much of Mako's expertise is devoted to these purification steps.

I visited Mako's modern plant located in the new industrial park near Ocala in central Florida. The recent move from Miami has evidently been as good for Mako's business as it has for Klein's psyche. The plant is large and spacious and the number of employees is up from seven, just five years ago, to over 38. I toured the plant with Mako's vice president, Tom Moore, an effervescent individual who is equally at home with engineering or sales. I watched every step of the assembly of a Mako compressor from frame to finished product, from standard to custom design. There is an obvious professionalism here with as much attention devoted to the application of a coat of paint as to the design of a gauge console. Mako presently manufactures 16 models of high pressure compressors — from small portables to huge diesel units — but many more high and low pressure compressors are planned for the future.

Klein's reputation as a director of underwater film projects often overshadows his engineering expertise with air compressor systems. In the 1950's he shot the stills for the *Creature from the Black Lagoon*— a classic screen monster. He shot the stills for *20,000 Leagues Beneath the Sea* as well. During the

1960's he and Ivan Tors made TV's *Flipper* one of the most popular animal shows of all time. Presently he produces about half the TV commercials that are shot underwater and is planning another TV series with Ivan Tors in the near future.

I welcomed the opportunity to interview Klein during our lunch in Miami and later on in the air as we flew to Ocala in his private twin aircraft. He speaks softly but with the knowledge and authority that comes with a lifetime of devotion to his work. Take a look at the future of compressed air technology with the man who wrote the book.

JORDAN KLEIN, WET ENGINEER

A close look at the present and the future of compressed air technology with the wizard of Mako.

"The potential is beyond my wildest dreams. Within 10 hours I could have 15 engineers and the most sophisticated computers in the business at our disposal."

SDM: You have achieved notable success in both underwater film production and in the manufacturing of air compressors although they don't seem to be closely related. How did that happen?

KLEIN: Both developed out of a common need by industry for something that was not there. I anticipated the need for quality compressors and air purification systems at a time when it was a very serious potential weakness in the dive industry. As for the film business, again, industry

came to me for professional help when I was making camera housings. The common link between the two which holds my attention is the engineering problems involved. I am basically an underwater problem solver, a wet engineer if you will.

SDM: At Mako, there is tremendous emphasis on air purification and the production of non-toxic air. But a high pressure oil lubricated compressor is capable of producing its own pollutants. Is this not a major engineering problem?

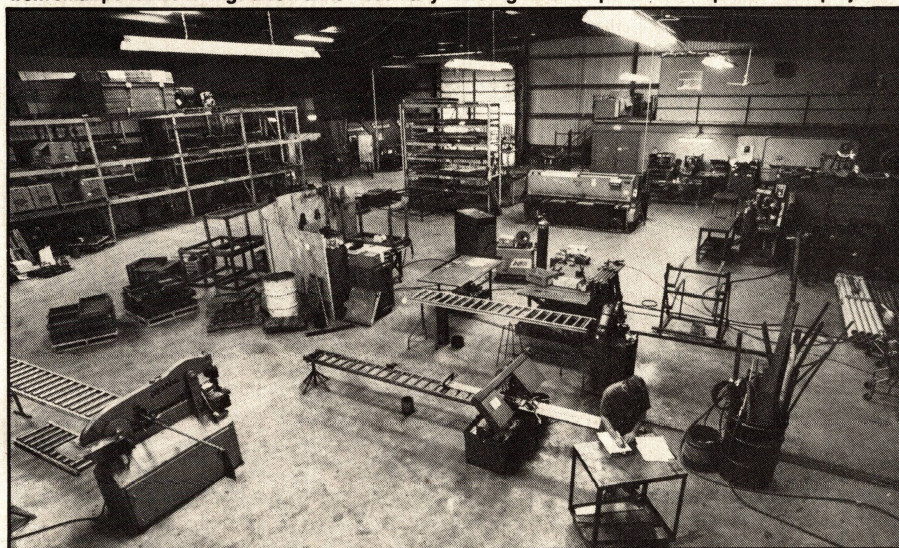
KLEIN: We have taken a hard look at oil free compressors for the dive industry. The lack of logic in pursuing this is simply that most compressors are contaminated not by the compressor but by the source.

Most are near parking lots or at least located in the city. Right here where we are sitting we are breathing air which is five or six parts per million contaminants (CO or CO₂) which is already near toxic at ten atmospheres. So you are already in trouble before you start. The emphasis must be on the design of the purification system and on preventive maintenance.

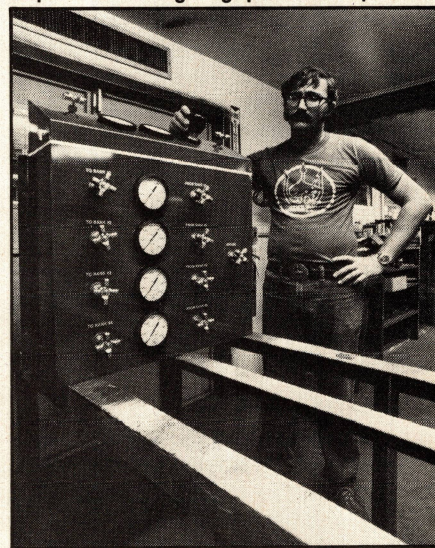
SDM: So an important part of the success of having purified air is maintenance as well as engineering?

KLEIN: If the operator has the attitude that the compressor is running and therefore everything is okay, like some people have with their car, they run the risk of producing toxic air. Therefore, it is important to have a warning device in the system to signal the operator. At Mako

The Ocala, Florida plant where Mako presently manufactures 16 models of high pressure compressors — from small portables to huge diesel units—but many more high and low pressure compressors are projected.



Mako is anticipating industry needs by gearing up for production of larger high pressure compressors.



JORDAN KLEIN

we have electronic monitors available that run with the compressor and will shut down the machine and/or signal the operator. This is an accessory that is fairly expensive, \$800 to \$1200. A simple and inexpensive device is a visual color change indicator that shows the presence of either moisture and/or CO₂. It comes standard with all our high pressure air purification packages.

SDM: How does someone shop for a compressor? Or in other words, what do I need to know before I start looking?

KLEIN: You have to establish some parameters. You have to know how many tanks you will need to fill in what period of time. From that, you can get a good handle on the size and type of compressor you are going to need. Also you must anticipate your needs in the future, not two years from now, but the immediate future. Since Mako compressors have an excellent resale value, it's always possible to trade up to a larger machine if the need arises. We always have a list of people who are looking for used machines. Everyone is going for bigger machines and yet there are plenty of people to take up the slack on the smaller machines with trade-ins. Many times we put two people together who are a long way from Mako. We sell the new machine to the person who has made arrangements to sell his smaller one.

SDM: Mako compressors are very popular. I see them in my travels throughout the Bahamas and the Caribbean as well as in the States. What do you think is the main reason for this success?

KLEIN: The primary reason I would have to say is service. This goes above and beyond the warranty period if we feel the consumer has a legitimate claim. We resolve the problem at Mako immediately. The availability of parts would probably be number two. Also, there is a high degree of reliability — we have over 8000 units presently in the field.

SDM: The majority of your customers come directly to you, do they not?

KLEIN: No, perhaps 20 percent. We prefer the dealer/distributor setup. We also set up dealers that will also provide service. Since there are so many machines in the field we are trying to make it easier for the consumers. That way they all have service and parts immediately. We started the high pressure compressor and purification school four years ago. Originally

we did it mainly for the military. Since then we have averaged one class a month. We teach the theory, how to take apart the machines, purification, workshop, preventive maintenance, etc.

SDM: What is the scope of your distribution? Is Mako distributed throughout the world?

KLEIN: Yes, and particularly now that we are part of the CompAir group. We now have 123 potential warehouses throughout the world to aid in storage and distribution.

SDM: What is CompAir?

KLEIN: Mako was sold a little over a year ago. CompAir is our parent company and it is based in London. CompAir is the fifth largest compressor group in the world.

SDM: What does CompAir mean to Mako, its customers and the industry?

KLEIN: CompAir is a tremendously strong concern, highly respected in the field, offering strong technical and financial support. Mako wasn't sold to get rid of it or to let it slide. What happened is that Mako got to a plateau and I didn't know how to get it to go further or have the financing to do it. In business, if you stand still you go backward. Soon competition would have overtaken us and we would have been yesterday's company. As it is now, we have taken a gigantic leap forward. We have the entire CompAir line at our beck and call which means we are involved in low pressure compressors for many industrial and military applications such as submarines, nuclear plants, offshore oil, food packaging, etc. Presently, we are handling 16 high pressure compressors, many different low pressure machines, perhaps more in the future. Technologically, financially and in terms of distribution, we now have fantastic advantages that I could have only dreamed of.

SDM: You anticipate that the name Mako will still be retained?

KLEIN: The name will definitely be retained and the day-to-day operation is still under my supervision. The things that Mako wanted to do have been left in my hands, even to the point of purchasing other companies to aid in Mako's growth. We are presently considering several acquisitions.

SDM: Do you anticipate that the industry will have to gear up for larger high pressure compressors?

KLEIN: Yes, absolutely. Everyone is in-

terested in higher pressures and greater flow rates. To accomplish this we have added reliable high capacity water-cooled machines to our product line.


SDM: A NASA spin-off has produced prototype spun fiberglass and stainless steel scuba tanks that hold 10,000 psi. Is this technology a few years away for the average scuba diver?

KLEIN: I don't believe that will happen. I was involved in all of that years ago and that's when I insisted all of our machines be produced for 5000 psi when you couldn't even get a regulator to function at that pressure. I knew then that 5000 psi was coming and with the knowledge that I have now, 10,000 is not coming, not for the average diver. There is too much risk involved. You're dealing with a case of dynamite, with glass anyway. The 10,000 psi fiberglass vessels made by NASA were designed for a single cycle, one filling — that's all. Every time you pressurize a glass vessel, thousands of fibers fracture and there is no way you can hydro test a glass vessel. At 10,000 psi there would have to be a complete change of design and materials for compressors. Even the dynamics of the air itself change. The air becomes quite heavy and you start getting into buoyancy problems.


SDM: So you believe that within the foreseeable future, say the next 10 to 15 years, we will be right at 5000 psi?

KLEIN: Right. Safety is the main reason. The Navy might go higher but not the sport diver. Most of the regulators on the market today are still marginal at 5000 psi so the industry will be gearing up to 5000 psi for some time.

SDM: At Mako, you expect a time of expansion, new ideas and increased production?

KLEIN: Absolutely. Doors have been opened to industry that I never thought I would walk through. Let's face it; Mako has always been a "poor boy" operation. We started out with a nickel and then we had two. Now we have dollars available to us. The potential is beyond my wildest dreams. Within ten hours I could have 15 engineers and the most sophisticated computers in the business at our disposal. Many new products will be brought out as needed in response to safety and practicality. I have no doubt that the dive industry will look more toward Mako in the future. 

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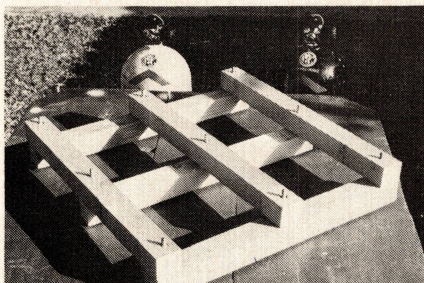
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A TANK RACK FOR YOUR TRUNK

BY STANLEY E. ALBA



All who dive regularly face many problems in handling scuba equipment. Well, here is an easy, quick and inexpensive idea that will stop your loose tank(s) from rolling around in your car trunk. While there are a few commercial tank racks available for boats and trucks, there weren't any to keep tanks neat and orderly in cars. It may also prevent a few dents, or damage to your trunk.

This easy to make tank rack can accommodate three to six tanks, depending on which design you choose and how deep your car trunk is. If your trunk has at least 26 inches of clear-

ance, you may be able to place up to six tanks on the large rack.

MATERIALS NEEDED

For a two or three tank rack you will need nine 2x2 inch studs 18 inches long, and 12 nails, or screws (or nine bolts). For a three to six tank rack you will need four 2x2's 18 inches long, and three 2x2's 26 inches long, and nails, screws, or bolts. (See diagram.) Using these measurements, there will be enough area to allow 50, 71.2, and 80 cubic foot scuba tanks to fit on the same rack. It is best, however, to put the smallest tanks on top and the largest on the bottom.

ASSEMBLY

The first step is to gather the materials needed for the rack size you have chosen. I chose bolts for two reasons: For strength, and because by loosening the nuts the whole rack can be disassembled to save space. Using nails, it would be much faster to assemble, since no holes need to be drilled, but nails are more permanent.

Before putting any pieces of wood together, it might be wise to check the actual thickness of the wood since it is likely to be less than two inches square (mine was 1 1/8 inches). If it isn't, you may be able to cut off some of the excess wood for a snug fit. To find out how much, place two or three tanks on the wood and put a stud between them, then mark where to cut.

The second step is to nail, bolt or screw the wood together in a square (rectangular for three to six) form, being careful not to split the wood. Place an 18 inch stud in the center, leaving about six inches between the studs. (Note: To keep 50's and 71.2's from rocking, a five and one-half inch space is needed.) For the two to three tank rack, turn the form over and place the last stud in the center, with the same six inch spacing. The advantage of having both sides the same, is that the rack can be used no matter which side is up.

After placing both 18 inch studs in the center, and spacing them properly on the three to six tank rack, turn the rack over and place the remaining 26 inch stud in the center. This rack can be used on both sides also, except that the maximum number of tanks that can be held on one side is six, while the other rack holds three.

It is recommended that if the sixth tank is in place, some sort of restraining strap or tiedown be used. This is to prevent the tank from rolling off during a sharp turn.

Once these simple steps are completed, you can use the rack as is or go one step further and dress it up by attaching strips of carpet or neoprene rubber to the studs to help prevent slippage or scratching of the tanks.

Without the final extra finishing step, the cost of construction is easily under \$10 and it takes about an hour. ➤



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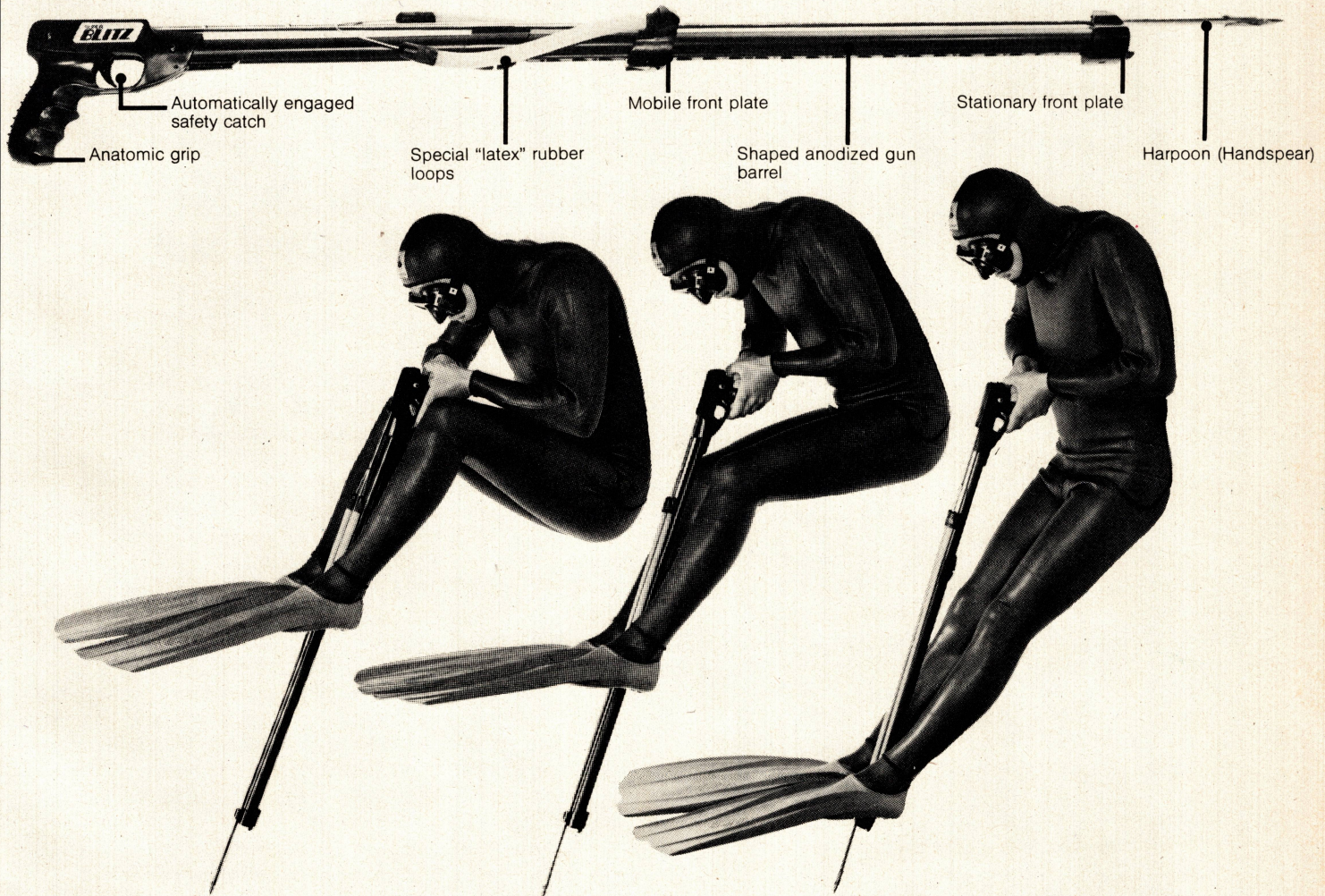
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RX FOR DIVERS

BY CHARLES V. BROWN, M.D.

Reader Feedback

Our July, 1980 column told of a young lady whose chest itched and burned after a Florida river dive. Several readers have come up with explanations. Doris Goldman of Narberth, Pennsylvania suggests swimmer's itch, caused by schistosome larvae that mistake a bather for their natural host and penetrate the skin. Gearly Hughes, diving control officer for the Pinella Marine Institute of St. Petersburg Beach, Florida reports that his men have experienced a rash with slight burning after contact with a weed called Hydrilla. He verified the phenomenon with the state Aquatic Weed Control Department.

The input is appreciated, but neither explanation quite fits, since she of the burning breast did not develop any rash. Thomas Straith, a Michigan microbiologist, suggests contact dermatitis — a sensitivity reaction to some chemical in the T-shirt worn. That's certainly a possibility in these days of synthetic fibers and additives. It can be easily checked out by wearing the same shirt in a swimming pool.

Question: Hector Veloso of Cebu City in the Philippines says, OK, I can understand why nobody wants to publish information about underwater recompression for the bends. But we dive in a remote corner of the world. The nearest chamber is more than 400 miles away on a different island, and there's no air transport.

Answer: In most parts of the world the bent diver will be much better off if all efforts are bent to getting him into a chamber rather than recompressing him in the water. Your area may be an exception. The Australians faced the same problem, and have developed a technique for underwater recompression using oxygen and a dry helmet. The logistics are formidable, so don't try it without thorough preparation. We've sent you a reference for obtaining the details.

Question: A San Francisco diver — an experienced, intelligent adult — made mistakes that cost him. On the first two dives, 60 footers, he had some trouble equalizing ear pressure, but nothing he couldn't handle. On the third go, severe vertigo hit him while descending to 35 feet. It only lasted five to ten seconds, so he went on with the dive. Surfacing, he became aware of some hearing loss and the feeling of a plugged ear. He assumed a ruptured drum and stayed dry.

Three days later he saw a doctor who reported both eardrums intact. He rode it out another three days, then had an audiogram. The left ear was essentially deaf. The next day he had an operation. A rupture of the oval window (between the middle and inner ear) was found and repaired. Now eight weeks later he has regained much, but not all, of his hearing. There is a slight ringing, and some popping and cracking when he swallows. "I hate to think I'll never dive again," he says. "Is there some test to see about it?"

Answer: We've talked of ruptured windows many times, yet letters like this keep coming in. Obviously, not all divers read all issues, so we'll keep hammering.

The mistakes? Our man should have stopped his descents at the first hint of difficulty equalizing. On the third dive, he either descended more rapidly than he could equalize, or else used a too-strong clearing maneuver. Anyway, the severe vertigo attack created a presumption of a ruptured drum or window, so he should

have aborted the dive and hied himself to an ear specialist with alacrity. Persistence of symptoms after the dive emphasized the need for prompt consultation. He was lucky — he got much of his hearing back. Many do not.

As of now, the ringing noise you mention attests to persistent inner ear damage, and the popping and cracking noises to persistent eustachian insufficiency. Assuming that these clear up, what about future diving? Most would say no. We happen to believe in freedom of choice, so would allow a very iffy maybe. You might dive again if: Your doctor says everything is well healed; you don't get dizzy in the water with your eyes shut; diving is very important to you; you can trust yourself to abort a descent anytime clearing is not super easy; and good hearing is not so important to your work or hobbies.

Good eustachian function is an absolute must for any future diving, and there are some fairly simple tests for it. Can you inflate your middle ear at any time by gentle use of a clearing maneuver? Can your ENT doctor confirm this by witnessing free movement of the eardrum when you perform this maneuver? Can you equalize easily while riding down a mountain in a car or descending in an airplane?

A prime rule of diving remains, never descend when you can't clear easily. The penalty for violation may be window rupture, with deafness, dizziness, or ringing noises. They can be permanent. It's not worth it.

Question: Greg Little of Tulsa, Oklahoma gets a bad toothache while diving. It's in the upper molars — sometimes on the right, sometimes on the left. Why?

Answer: There are two possibilities. If you've had cavities filled, they could be expanding and the problem could be tooth squeeze. More likely, though, you have maxillary sinus squeeze, a disorder

(Continued on Page 94)

micronesia

ponape

truk

guam

palau



**skin diver magazine
special supplement**

photograph by Paul J. Tzimoulis

micronesia odyssey

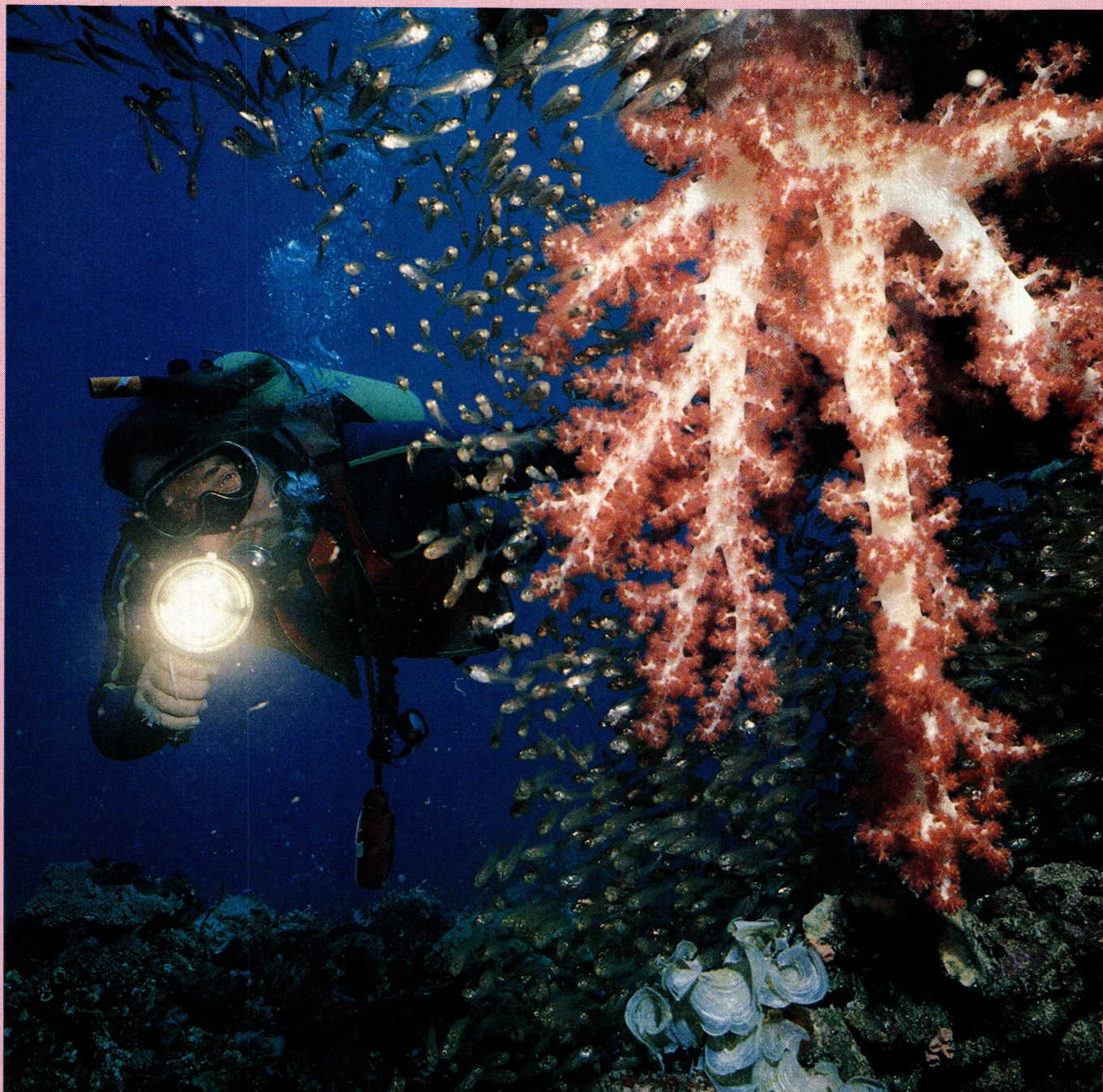
Some 6000 miles out in the blue Pacific lies the incredible world of Micronesia. It is an exotic and enchanting world with lush jungle islands, wild parrots and monkeys, crystal clear water and some of the finest diving to be found anywhere in the world today.

Micronesia is not an island or even a string of islands, but instead, a vast

sprawling chunk of the Pacific almost the size of the continental U.S. Somewhat rectangular in shape, the boundaries of Micronesia are about 2800 miles long and 1800 miles wide. You could fit the entire Caribbean into one corner of it and still have room for the Mediterranean, the Red Sea, and the Coral Sea. And sprinkled across this im-

mense stretch of open ocean are some 2141 tiny islands. On most maps of the world they appear as small dots, for their combined land area amounts to 528 square miles, less than half the size of Rhode Island! The total population of this ocean wilderness is estimated at 130,000 people.

The single thread that ties together



photograph by Geri Murphy

into adventure

By Paul J. Tzimoulis

these far flung islands in an endless sea is a marvelous airline called Air Micronesia. An independently operated division of Continental Airlines, Air Micronesia has two modern 727 jets which serve a total of ten islands within Micronesia, as well as Hawaii and Okinawa. The planes are flown by top notch pilots, crewed by friendly stewardesses, run pretty much on schedule and the food served aboard these flights is excellent by airline standards. The flights carry the U.S. mail; cargoes of priority and perishable goods; and vacation bound passengers. Air Mike, as it is known among the islands, is a modern airline in a primitive paradise.

Micronesia's greatest attractions are its most abundant natural resources — the waters and marine life which encircle these islands. Here you will find some of the finest coral reefs and vertical drop-offs to be found anywhere in the world today. The underwater creatures that inhabit these reefs are exotic and totally different from anything you might find in U.S. or Caribbean waters. Soft corals in electric colors seem to sprout from every coral head and shipwreck railing, while thousands of sparkling baitfish dance before the diver's eyes. There are mammoth shipwrecks still totally intact and preserved since the stormy days of World War II. Underwater visibility of 200 feet is common along the outer edge of most barrier reefs and the variety of passing marine life leaves most divers speechless. A trip to Micronesia is considered the supreme dive adventure, and something every scuba diver must do at least once during his/her underwater career.

Unless you are an extreme individualist by nature and unconcerned about your travel budget, the best way to dive Micronesia is with a tour group. Micronesian hotels, dive boat operators and taxi drivers are tour-group oriented, as much of their business is conducted in this manner. Tour groups usually get the best prices for dive boat trips, taxi rides, and airline reservations. Dive tour groups usually range in size from 6 to 12 people and often have an experienced escort handling the travel and dive arrangements. Since the escort has been there before, he or she knows exactly where to go and who to contact for prompt and personal attention. During my tour of Micronesia, I met five different dive tour groups who were traveling the islands and enjoying their diving

immensely, the tours were invariably well run.

In order to taste a sample of the excitement and adventure of Micronesia, join us now as SKIN DIVER conducts a guided tour of these fabulous islands. We will take you on an imaginary trip through this tropical wonderland with Air Micronesia as our magic carpet across the wide Pacific. Here is what you might expect along the way.

To dive Micronesia one must undertake an unusually long journey; almost an odyssey. It takes the better part of two full days and many hours of monotonous flying to reach even the closest island for diving. And then, still more travel from island to island. In all there are five different islands which currently offer dive facilities for visitors, and more are springing up all the time. Most of today's diving occurs around the islands of Ponape, Truk, Guam, Saipan and Palau. If you visit all of them, your journey will cover more than 12,000 miles (from Los Angeles) alone.

The Pacific portion of such an odyssey usually begins from one of the West Coast's gateway cities such as Los Angeles. SKIN DIVER begins the trip from L.A. International Airport by climbing aboard a spacious Continental Airlines DC-10. The trip to Honolulu, Hawaii is nonstop and usually takes five hours.

Since there is only one Air Micronesia flight departing twice weekly in the early morning, it is necessary to stay overnight in Honolulu. The best place for a quick and convenient overnight stay is in one of the several hotels right in the airport area. SDM chose the Airport Ramada Inn because of its close proximity (a two minute drive) to the air terminal. The Ramada also provides courtesy van transportation to and from the hotel. We needed only pick up the courtesy phone at the baggage area and ask for the van — it arrived within 5 to 15 minutes.

The first leg of our Micronesia odyssey is perhaps the most difficult. It is the day in which we travel the most. Hotel wake-up call is 6:00 am, with a quick check-out and van ride to the airport at 6:30 am. Check-in time at the Air Micronesia counter is 6:50 am with a scheduled departure at 7:50 am. This gives us enough time for a fast cup of coffee at the airport cafeteria. Breakfast will be served later, on board the flight. Check-in consists of presenting our ticket and showing our passport or equivalent proof of U.S. citizenship. A birth certificate or voter's registration

card will do just as well. If everything goes according to schedule our plane will be in the air and passing Waikiki Beach by 8:00 am.

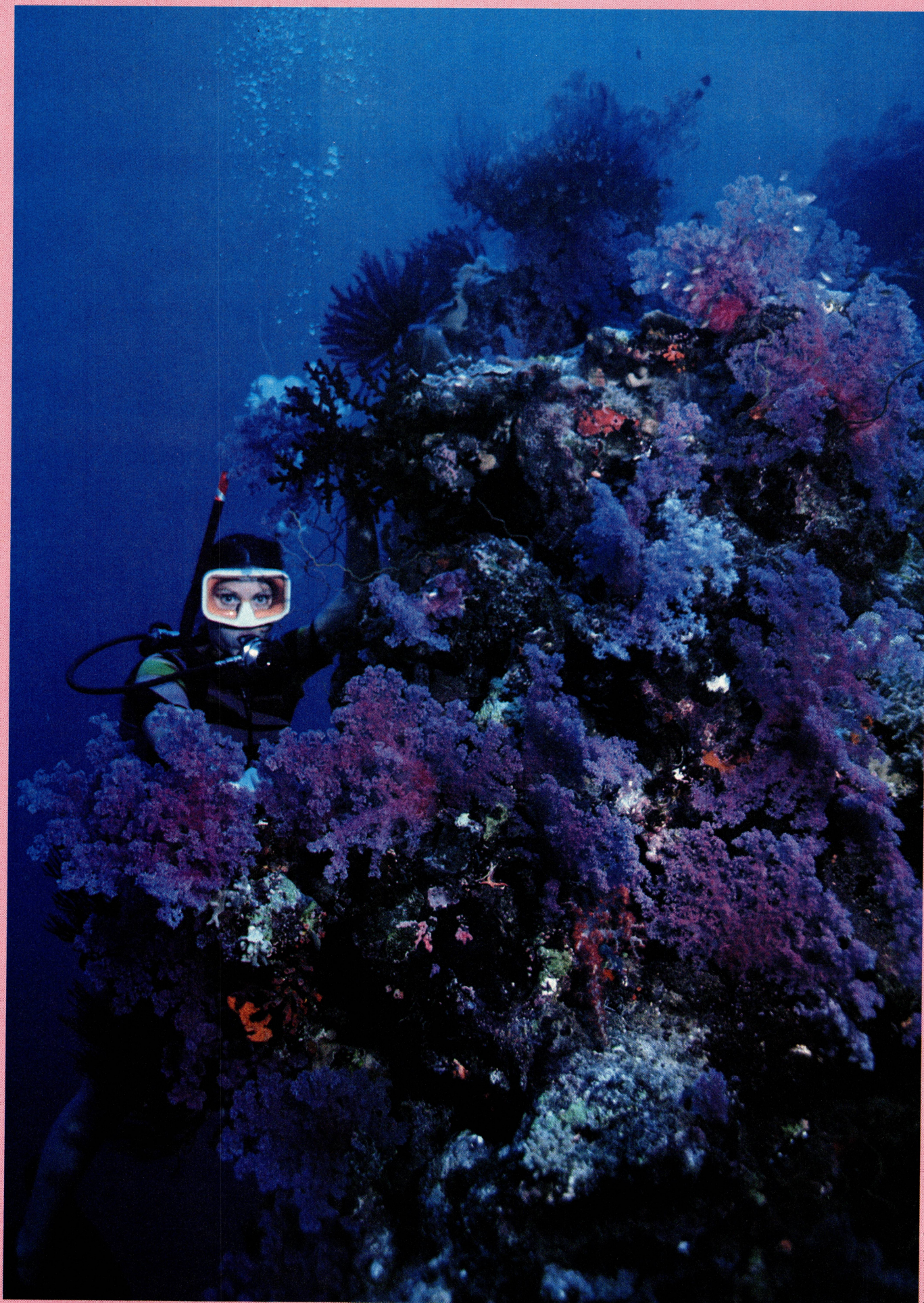
The Air Micronesia flight is often called the "milk run" as this flight will spend the next 14 hours landing and taking off from five islands between Honolulu and Guam. Intermediate stops include Johnston Island, Majuro, Kwajalein, Ponape and Truk.

The flight from Honolulu to Johnston takes approximately two hours. Johnston is a restricted military base on a small speck of rock in the mid-Pacific. The stop here is a brief one with only 15 minutes for refueling. The passengers generally remain on board with little more than a view of a sun-baked and deserted runway.

Climbing back up to an altitude of 35,000 feet, the Air Micronesia jet continues its course in a southwesterly direction. It will be another three hours of flying before this plane lands again. Halfway between Johnston and Majuro, the flight crosses the International Date Line and we are instantly transported into tomorrowland. Saturday suddenly becomes Sunday and a day is lost from the calendar. This transition has an unreal quality about it: It is difficult to comprehend the loss of an entire day. The time is the same, but the date and day are different. It is nothing to worry about however, as we shall regain that day when we cross the Date Line on our return journey.

Touch down at Majuro signals the beginning of Micronesia. Located in the Marshall Islands group, Majuro is regarded as the eastern gateway into Micronesia. It is a large atoll, 25 miles long and ringed by many small islands and reefs. Majuro boasts a modern jet port, modest terminal facility, small handicraft shop and a restaurant that serves excellent chow mein or fried fish. The stop at Majuro is approximately 20 minutes, offering us an opportunity to deplane and stretch our legs.

It is barely a 30 minute flight from Majuro to Kwajalein, another major island in the Marshall group. There are close to 90 islands along the rim of this atoll but it is off limits to civilian visitors. Kwajalein is a missile tracking station under the jurisdiction of the U.S. Army Redstone Arsenal. Our stay at Kwajalein is brief and we do not leave the plane. Within 15 minutes we are again airborne and winging our way westward.



photograph by Carl Roessler

ponape

It is mid-afternoon of the second day of travel before the island of Ponape comes into view. And what a sight it is, for Ponape is the first island we will dive. The flight from Kwajalein has taken a little over one and one-half hours.

Ponape is by far one of the most beautiful islands in eastern Micronesia. It is a high volcanic island with lush green mountain ridges, cascading waterfalls, winding streams, secluded valleys and dense tropical rain forests. Ponape is the perfect picture of a tropical island paradise, complete with coconut trees and wild banana trees.

We are greeted at the small Ponape air terminal by a crowd of more than 100 colorfully dressed Micronesians. They are a mixture of local residents waiting to greet arriving friends and travelers bound for other islands along the chain. The terminal is jam-packed and clearance through immigrations and customs takes at least 20 to 30 minutes.

The hotel has sent a truck to pick us up; there are at least one-half dozen arrivals headed for the Village Hotel. The truck is a converted flatbed which can carry 22 passengers and has plenty of room for dive equipment and luggage. Although the hotel is only six miles from the airport the trip takes 40 minutes. We slowly weave and bump our way along a rutted dirt road while the driver tries to avoid the deeper potholes. Our journey ends at the top of a foliage-covered mountain ridge upon which is perched Ponape's most beautiful and best run hotel.

The Village is a very special kind of resort, obviously designed and created

with loving care. It is built to resemble the old-style Micronesian home for a Ponapean chief. The roofs are made of hand-woven thatch and wood carpentry. The walls and floors are built out of sturdy mangrove lumber and mahogany. The main building is a combination outdoor dining room, cozy bar and lobby area. However, one entire side of this building is open to the sea, providing a spectacular view of the lagoon and barrier reef below. The rooms are actually 21 individual bungalows set apart from each other for ultimate privacy. Each bungalow has a marvelous view of the ocean and an attractive interior appearance with some surprising features. They are furnished with waterbeds, overhead fans, and have modern toilet and shower facilities. Three sides of the bungalow have large screened windows that take advantage of the gentle, but cooling, sea breezes.

Upon our arrival we are greeted by Bob and Patti Arthur, owners and managers of the Village. Formerly from Southern California where Bob was an industrial design engineer, the Arthurs moved to Ponape in the early 1970's. Bob actually designed and built the entire Village complex himself, and opened for business in 1976. Since then he and Patti have become tropical innkeepers while raising a family of three teenagers.

Our first evening meal at the Village turns out to be an astonishing but delightful surprise. We discover that the Village offers gourmet style meals. The Arthurs have an Hawaiian chef who prepares some of the most scrumptious dinners you will ever experience anywhere in Micronesia. My choice of entree was maca-

damian nut chicken, while other guests ordered delicacies such as teriyaki steak, sweet and sour chicken, mangrove crab, and ponape peppersteak. All servings were perfectly prepared and we finished off the meal with an honest-to-goodness hot fudge sundae.

At breakfast the next morning Bob Arthur explained the dive set up. The Village has the one and only dive shop operation on Ponape and it is conveniently located right on the hotel premises. The air station consists of a Poseidon seven cfm compressor which pumps up to 2300 psi and a storage bank of ten 240 cu. ft. cylinders. Bob maintains an inventory of 50 rental tanks, all 72 cu. ft. steel tanks. He also has an assortment of backpacks, weightbelts and snorkeling gear. Regulators and BC's are not available. If you plan to dive in Ponape you must have your own BC, regulator, submersible pressure gauge, depth gauge and other accessories. Guests are required to present their certification cards.

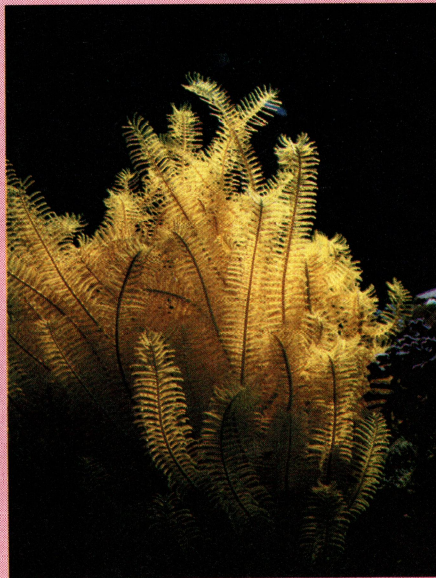
The Village has a total of four boats that can be used for diving when necessary. The dive boat normally used is a specially designed 30 foot Ponapean built catamaran. A wide platform deck provides spacious room for dive equipment storage and seating for the guests. A large canvas roof provides shade and the tanks are stored in special racks in the twin hulls. The dive-cat is powered by twin 115 hp Johnson outboards and will carry up to 15 divers comfortably. The Village also has a 23 foot fiberglass fishing skiff powered by twin 25 hp outboards, equipped with a dive ladder. It is large enough to carry up to eight divers. Two 18 foot wooden skiffs, also powered by twin outboards, are large enough to carry four divers each.

The Village has three full-time underwater guides; all Ponapean divers who have received NAUI diver training and certification. While these divers are not scuba instructors, they are excellent guides. They have dived these reefs since childhood. The chief divemaster is Manuel Semes, the guide who generally conducts the group dives. Olter Andon and Joe Donre are the other two dive guides.

Our dive trip was scheduled for a 9:30 am departure. Personal dive gear and underwater cameras are brought up to the front lobby from the rooms and then transported by truck down the hill to the boat loading area. Meanwhile, guests follow a winding trail from the hotel down to a secluded little cove in the mangroves. Our boat ride to the first dive site takes approximately 55 minutes because our guide had selected an especially beautiful drop-off on the southwest side of the island. Ponape is encircled by a barrier reef which lies one to five miles offshore. Between the barrier reef and shore is a glassy calm lagoon filled with shallow coral reefs and small islands. With our



Clownfish, Ponape



Yellow feather star, Ponape

photographs by Geri Murphy

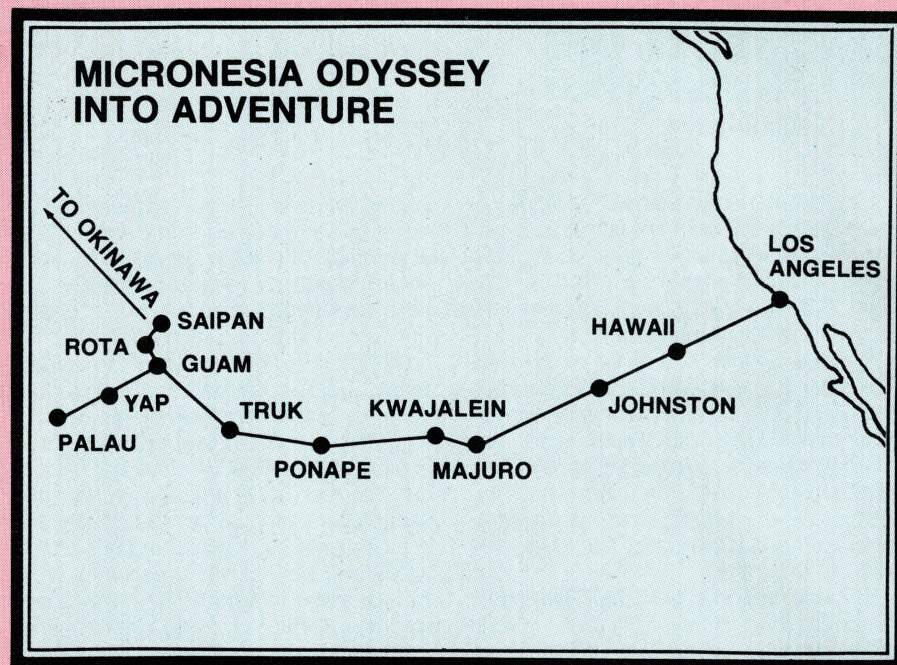
dive site close at hand, our guide turns the boat seaward and slips through a deep water passage in the barrier reef. Once outside, we follow the blue water line for a few hundred yards and anchor directly off a small mangrove island. This site is the Kepara Drop-off.

The dive guides help us set up our scuba gear and we are in the water within minutes. Below the boat is the large sprawling reef in 35 feet of water. The bottom is covered with densely packed hard corals. Unlike those found in the Caribbean, there are giant table top corals for as far as the eye can see and other hard coral structures which are distinctly Pacific in origin. Our divemaster, Manuel, leads us to the drop-off. It begins at 40 feet, and drops straight away into the cobalt blue depths of the open sea. The underwater visibility is breathtaking — at least 150 feet or more. The face of the wall is covered with all types of coral life including many strange alcyonarians, sponges and other exotic marine life. At 80 feet we encounter an incredibly large deep seafan — one of the biggest I have ever seen. Growing straight out from the vertical wall, this gigantic fan is at least 15 feet high and 6 feet wide. The mammoth fan is yellow/orange, even at a depth of 80 feet. A school of pink and purple damselfish cluster around the fan for protection. It is an absolutely beautiful sight.

Approximately five feet above the giant fan is an amazing cluster of feather stars. These creatures are similar to the Caribbean crinoids except they are larger and remain out on the reef during the day. This cluster contains eight separate feather stars, grouped together in pairs, and each a different color combination. The most outstanding one is a brilliant canary yellow and can be seen 50 feet away. Next to it is a black crinoid with yellow fringes. Another is deep red with white fringes. We desperately fight against the clock in hopes of photographing all of them.

With our bottom time nearing the limit, we move up the wall and into the shallow coral reefs. Here we find several large doormat-sized anemones occupied by clownfish. There seem to be two clownfish to each anemone and they are unafraid of us. They dart in and out of anemone tentacles as we line up our close-up framers for photographs. They become an easy subject for a 1:4 or 1:6 close-up lens. In fact, one pair of clownfish is so friendly we are able to photograph them with a 1:2 extension tube. The clownfish is almost irresistible for photography. It has a bright yellow face and fins, a black body, and two bluish-white vertical stripes with an electric blue edging. It is indeed an exotic creature.

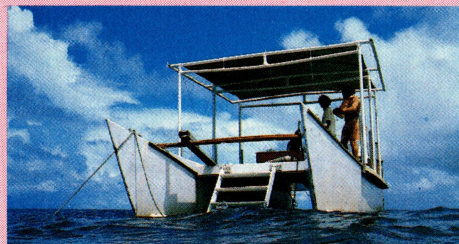
Nearby is another of those brilliant feather stars attached to a four foot high coral pinnacle. Intermixed with the brilliant yellow arms are small formations of



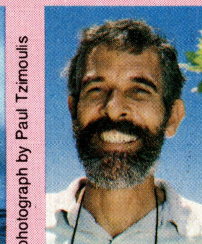
bright purple coral — a spectacular color combination. As we look around the reef, we see many other creatures to photograph: small tridacna clams with brilliant blue mantles; bright chrome yellow sponges; a single striped tomato clownfish and so on. The diving is so good, we must stay for another tank in order to photograph everything we see. As we begin our ascent along the anchor line we look

back over the wall to see a school of jacks cruising by and a gray shark lazily swimming along the edge of the wall. Diving in Micronesia is indeed everything we had dreamed it would be.

Kepara Drop-off is just one of perhaps a dozen excellent dive spots around Ponape. Tauak Drop-off is another spectacular spot for big coral heads and schooling fish. Nearby Tauak Pass is an



The Village dive boat



Bob Arthur

photograph by Paul Tzimoulis



The Village Hotel



Ponape waterfall



Nan Madol ruins

photographs by Gen Murphy

50% More Diving in Micronesia!



Unique Wrecks of Truk Lagoon Plus Sensational Ponape

In Truk, See & Sea has designed an exclusive dive program in cooperation with Micronesian Aquatics which offers our divers three dives each day rather than only two. That's 50% more diving than any other offering in Truk, more opportunities to explore and photograph the fabulous sunken wrecks of the Japanese Fourth Fleet.

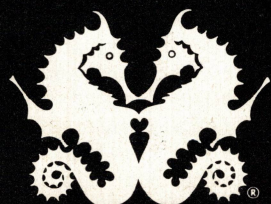
After Truk's fantastic wrecks, take a one hour flight to the beautiful island of Ponape. Here you'll enjoy another special See & Sea dive adventure. Designed in cooperation with the beautiful Village Hotel, our Ponape dive days will include three tanks each dive day. Once again, 50% more diving with See & Sea on Ponape's sensational outer reefs and precipitous drop-offs.



Fabulous Reefs of Palau

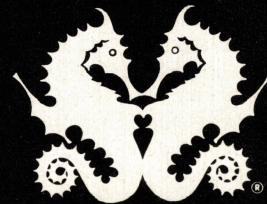
At the farthest limit of Micronesia dive with See & Sea on the world-renowned reefs of Palau, a new program. Our hotel, the Palau Continental. Our dive adventure, a special three-dive-per-day program by See & Sea in collaboration with Fish n' Fins of Palau. We see incredible 900 foot drop-offs, vast subsea caverns, blue holes, and some of the world's richest reefs. Our new program offers you 50% more of Palau's diving each day, so you can see the most and best of Palau's superb diving.

These great Truk Lagoon/Ponape and Palau programs offer you the most diving and the best diving in these exciting destinations. A true value for your vacation dollar. Special group charter arrangements available.



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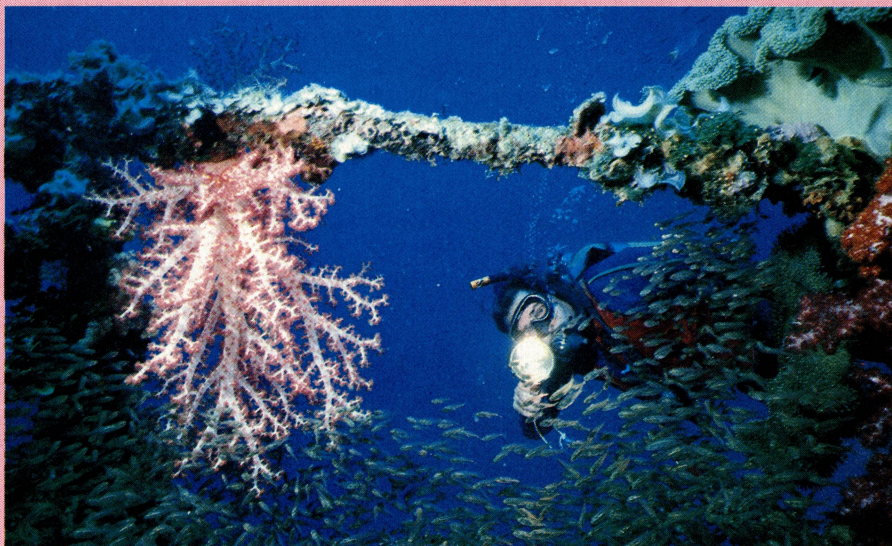
especially good spot for high voltage diving and shark photography. Param Drop-off has a reputation for super clear water (200 foot visibility), pelagic fish such as tuna, and shark action. Manta Drop-off is a good area for manta rays, schooling fish and other interesting marine life. Inside the barrier reef are many pretty coral gardens in shallow water. These sites are loaded with interesting marine life such as the brilliant blue starfish, small tridacna clams of every color, and small marine tropical fish. These spots are ideal for snorkeling as well as shallow water photography.

A visit to Ponape is not complete without a tour of the legendary lost city of Nan Madol. On the remote eastern side of the island are the stone ruins of an ancient and mysterious city which has defied historic explanation. Long ago a civilization of unknown origin designed and built a sophisticated network of artificial islands and canals covering an 11 square mile area. It contained over 100 man-made structures, built from extremely heavy basalt stone logs — some of them over 20 feet in length. While there are local legends dating back 700 years, archaeologists are not really sure who built Nan Madol or how old it really is. The main defense fort which guards the entrance to the city has walls 30 feet high and 10 feet thick. The tour of Nan Madol is done by boat and takes the better part of a day. In addition to touring the canal, visitors can actually walk among some of the larger stone structures which have been cleared of jungle brush. Also in the same area is a side trip to a magnificent waterfall, only a 15 minute walk inland. Our guide, Olter, brings along a picnic lunch that we enjoy under a shady tree beneath the cascading river.

As we prepare to leave Ponape, our minds are filled with images and memories of a classical Pacific island paradise. This lovely island has given us a taste of Micronesia and whetted our appetite for more.

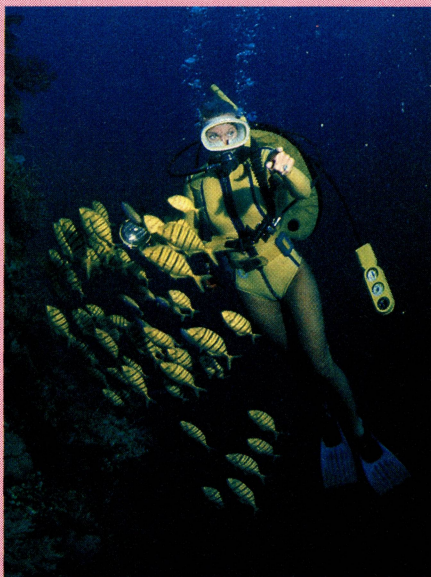
truk

It is mid-afternoon as we again board the Air Micronesia jet to continue our journey westward. The flight is a brief one hour and five minutes, as Truk is the very next stop in the Air Mike chain. From the air, we can immediately see that Truk Lagoon is entirely different from Ponape. Instead of one major island, there is a giant lagoon circumscribed by a coral barrier reef almost triangular in shape. The lagoon is immense, measuring 40 miles across at its widest point. The barrier reef measures an estimated 110 miles around the outer edge. Inside the lagoon are 11 major islands and over 100 small ones.



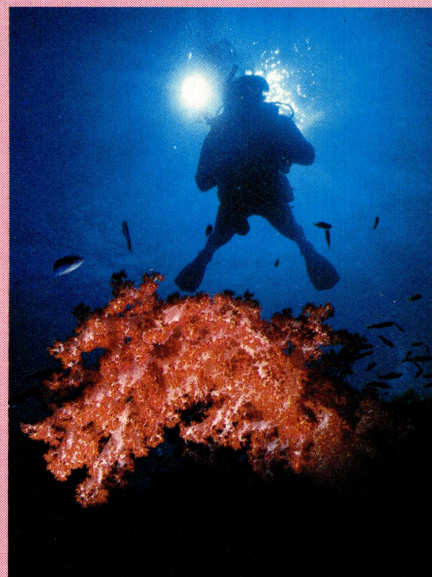
Soft corals and bait fish on railing of *Fujikawa Maru*, Truk

photograph by Geri Murphy



Shinkoku Maru, Truk Lagoon

photograph by Al Hornsby



Soft coral on *Fujikawa Maru*, Truk Lagoon

photograph by Geri Murphy

The vastness and quiet calm of the lagoon offers a feeling of tranquility.

Our plane circles the island Moen, the major commercial center of Truk. It is here that you find the airport, the harbor, the hospital, and the hotel. Our landing is witnessed by over 100 Truk islanders who have come to the airport to greet friends and visitors. Just as in Ponape, the Truk airport terminal is crowded and crammed with well-wishers. We again clear immigrations and customs inspections before being picked up in an air-conditioned van from the hotel. It is a six mile ride over bumpy dirt roads from the airport to the Truk Continental as the hotel is located on the opposite side of the island. The ride takes a good 45 minutes.

The Truk Continental is a modern luxury hotel in a primitive jungle setting. Comprised of three separate buildings, the hotel complex is situated on a point of land jutting out into the quiet lagoon. The hotel grounds consist of well manicured lawns shaded by tall coconut palms.

There are a total of 56 air-conditioned rooms, each with its own balcony and a magnificent view of the lagoon. The room interiors contain natural wood paneling, wall-to-wall shag carpeting, two double beds, sliding glass doors, modern bathroom facilities (shower and tub with ample hot water). The air-conditioning proves to be a welcome relief after a long hot day in the tropics.

We are greeted by the hotel manager, Hauoli Smith. A diver himself, Hauoli is always eager to talk about the wrecks and the history which envelops this incredible lagoon. His tour of the hotel facilities reveals a large modern dining room which is generously air-conditioned, a handicraft and sundries store, and a hotel pier from which the dive boats depart every morning. The Truk Continental does not have a cocktail lounge because it is a "dry island" and the sale of alcoholic beverages is prohibited by local law.

There are two dive operators on the island of Moen: The Blue Lagoon Dive Shop, at the harbor in town; and Micro-

nesia Aquatics, next to the Truk Continental Hotel. Both operations provide experienced guide services to the wrecks. In order to dive Truk Lagoon one must first obtain a dive permit which can be arranged by either of the two dive operators. To dive the wrecks one must be accompanied by a Trukese dive guide. This regulation was instituted in order to maintain a high level of dive safety and also to protect the wrecks from souvenir hunting. The Truk District government has instituted strict conservation laws in order to preserve its World War II legacy.

The main dive attraction of Truk Lagoon is a phenomenal collection of sunken Japanese ships, airplanes and one submarine. An estimated 100 wrecks lie at the bottom of Truk Lagoon, completely intact and preserved from the time they were sunk 26 years ago. During WW II Truk Lagoon was a major anchorage and western Pacific headquarters for the Japanese Imperial Fleet. The islands within the lagoon were fortified with giant guns, many fighter plane bases, submarine pens, and anti-aircraft weapons. Shore facilities included repair shops, fuel storage tanks, ammunition dumps, communication centers and military barracks. Ships were constantly being loaded and unloaded while moored in several deep water anchorages. At one time during the war, there were 40,000 Japanese troops and workers stationed on Truk.

In 1944 Truk Lagoon was blitzed by Allied bombers and fighters. In one attack alone, called Operation Hailstone, over 40 ships and 100 airplanes were sunk or destroyed. After the war, Truk was closed off to the public and commercial salvage operations were prohibited. Because the wrecks were left alone for almost 20 years, they are overgrown with an incredible array of soft corals, deep seafans, sponges and other beautiful forms of marine life. The warm nutrient

rich waters of this lagoon have served as a giant incubator for a most beautiful transformation. Today, the wrecks of Truk Lagoon are regarded as one of the Great Underwater Wonders of the World. No other place on earth comes even close to matching the beauty and fascination of this unique phenomenon.

Micronesia Aquatics is basically a dive charter service with headquarters just outside the Truk Continental Hotel grounds. It is owned and operated by Clark Graham, a former American Peace Corps worker who has settled in Truk. Clark has lived in Truk for eight or nine years and has an extensive knowledge of the shipwrecks and lagoon history. In fact, Clark has co-authored a book, *Diver's Guide to the Truk Lagoon* (\$5), considered the most helpful reference for divers.

The Micronesia Aquatics' air fill station consists of an Ingersoll-Rand 8 cfm compressor and a Poseidon 6 cfm compressor for backup. Clark maintains a rental inventory of 80 aluminum and 12 steel tanks. Rental regulators and BC's are not available, as Micronesia Aquatics caters only to experienced divers who are expected to bring all of their personal equipment.

Micronesia Aquatics maintains a fleet of four dive boats: three small skiffs and one larger craft. The large dive boat is a 42 foot steel hulled trawler powered by a diesel engine. It can carry up to 20 divers and will cruise at eight knots. It is the largest dive boat presently being used anywhere in Micronesia. In addition, there are two 22 foot fiberglass skiffs powered by twin 50 hp Johnson outboards. These smaller boats will carry up to eight divers and run at 15 knots. There is also a 21 foot plywood skiff powered by twin 40 hp outboards, capable of carrying seven divers.

Micronesia Aquatics offers a basic

all-day two tank dive trip (\$45) and the dive boat departs from the hotel dock at 9:00 am. Tanks, weightbelts, backpacks and air are provided. A one tank night dive (\$30) on the wreck of the *Shinkoku Maru* is also available, with a departure time of 5:30 pm. Graham also makes special dive arrangements for group tours. He has at least one dozen different shipwrecks listed on his normal dive itinerary. He also maintains a staff of five experienced U/W guides: Bill Ryder, Raid Tipekis, Pisanin Auf, Berney Aniol and Mimi Rudolph.

We spend our first dive day with Micronesia Aquatics and join up with a See & Sea tour group which has chartered the big boat for the week. Our destination for the day is the wreck of the *Fujikawa Maru*. The boat ride takes approximately 30 minutes; we glide across glassy calm waters on our course toward Eten Island. The *Fujikawa Maru* was a 450 foot long Japanese aircraft ferry which transported fighter planes (Zeros), aircraft parts and ammunition to a fighter base on Eten Island. The ship was sunk by a torpedo bomber while in the process of being unloaded at anchor.

The wreck of the *Fujikawa* sits absolutely upright in 120 feet of water with both masts protruding above the surface. Our dive boat pulls up to the wreck and ties a mooring line to the forward mast — there is no need for an anchor. From the ship's railing we can make out the entire profile of the wreck below, pinpointing the bridge, bow, cargo hold and other cargo rigging. It is a tingling sensation to view such a large shipwreck in clear water. Everyone is rigged up and into the water within five minutes.

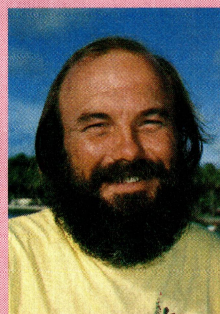
The *Fujikawa Maru* is one of those marvelous shipwrecks which can be enjoyed at almost any depth. Snorkelers find the upper areas of the mast and king posts covered with a lovely array of hard and soft corals. The top of the ship's bridge is only 40 feet below the surface, and the bow deck is at 45 feet. We find the upper decks of this majestic ship draped with a stunning array of colorful soft corals, anemones and sponges. The growth is more lush than a coral reef and the variety almost astounding. Great soft corals of crimson red, strawberry pink, canary yellow, soft lavender and deep indigo can be seen everywhere. They hang from the bow gun, the railings, the loading boom and even the mast. It is a photographer's dream world and it's hard to know precisely where to start. There are at least 1000 photographic opportunities, but so precious little bottom time in which to do the job.

The kaleidoscope of soft corals is but the beginning of our scenic tour, for the ship is occupied by a multitude of fish life. Great schools of tightly packed baitfish almost obscure the ship's bow. Circling the baitfish are larger fish including jack, mackerel, and snapper. We swim to the bow railing and peer over the edge

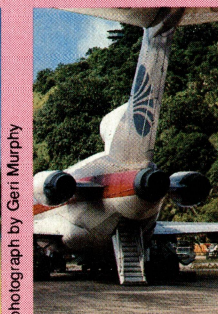


Micronesia Aquatics' dive boat

photograph by Geri Murphy

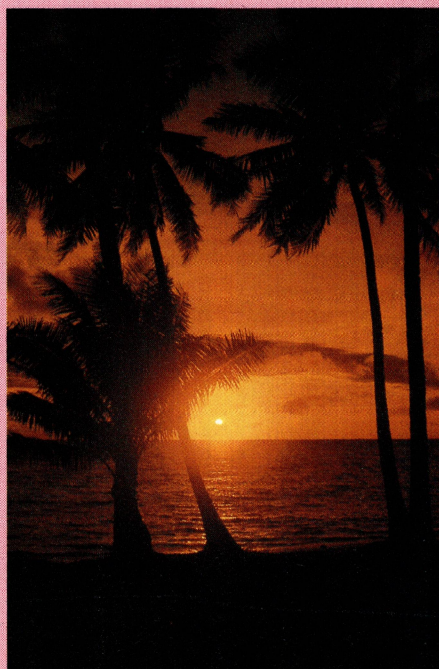


Clark Graham



Air Micronesia 727 jet

photograph by Paul Tzimoulis



Truk Lagoon sunset

photograph by Al Hornsby

where we see more fish. Eighty feet below us are three or four sharks swimming lazy figure eight's near the sand bottom. The wreck is literally surrounded by tens-of-thousands of fish. Such breathtaking beauty tends to boggle the mind and we find ourselves fumbling with the underwater camera controls as we frantically attempt to photograph everything in sight.

A tour of the wreck's interior reveals another side of the *Fujikawa*. The cargo holds and inner passageways are covered with thick layers of brown silt, and we feel like intruders in an ancient pharaoh's tomb. The bow compartment contains a load of four inch armor piercing naval shells and cases of machine gun bullets. The number one hold has a pile of aircraft propeller blades and machine guns for the wings of fighter planes. The number two hold contains a couple of intact Japanese zeros. Further on we discover tiled Japanese bathtubs, a pile of empty sake bottles, dishes, canteens and even gas masks. The interior of the *Fujikawa Maru* is an underwater museum that clearly documents the life and death struggle of WW II. The diving is so good on the *Fujikawa Maru* that the group decides to spend the entire day there, making two more dives.

Although the Blue Lagoon Dive Shop is located in town, its dive boats make convenient passenger pickups at the Continental Hotel dock. Blue Lagoon is basically a dive charter service. It is owned and operated by Kimiuo Aisek, Truk's oldest and most experienced underwater guide. Kimiuo was born and raised in Truk, and as a teenager he witnessed the attack and destruction of many of the Japanese ships which he now dives. He began his dive career with the Truk Fisheries Service and has been operating a dive business for the last ten years. Kimiuo has appeared in several underwater films about Truk, including, *The Silent Warrior* and *The Search for the Shinohara*, both produced by Al Giddings.

Blue Lagoon has an Ingersoll-Rand 12

cfm compressor and an inventory of 50 rental tanks. Like most Micronesian dive operators, this company caters primarily to those who bring their own regulators, BC's, and other personal dive gear. The shop has three, 18 foot custom built lagoon boats, which are powered by twin 40 hp outboards and carry up to seven divers each. Kimiuo has two experienced underwater guides, Chenisio Tipeeck and Ander Aisek, as well as himself. He offers a basic two tank boat dive on a sliding scale from \$35 to \$50. The larger the size of your group, the lower the cost per diver. A dive trip includes tank, backpack, weightbelt and air.

Kimiuo has an impressive repertoire of wreck dives which must number over 50 ships, planes, tugs, and a sub. He is constantly searching for new wreck sites and has just found 12 new locations. The choice of shipwrecks depends largely on the skill of the passengers, as he will take only expert veteran wreck divers to some of the deeper ships.

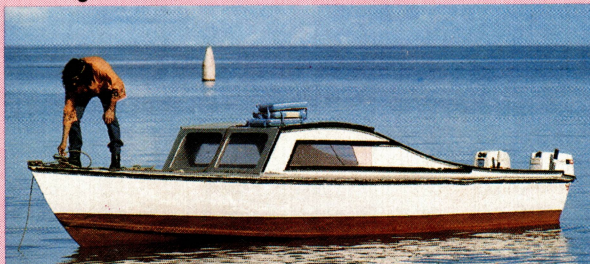
On the second day of our Truk visit, we meet Kimiuo at the hotel dock at 8:30 am. His lagoon boat is small, but quite comfortable; it has a forward cabin for shade protection. Kimiuo advises us that our first dive will be on one of his new discoveries — the X-4. Still unidentified, this ship lies upright in 160 feet of water, tilted to its port side some 30 degrees. Kimiuo suspects that the wreck may be the *Nippo Maru*, an ammunition and arms transport he has been hunting for ten years.

With remarkable accuracy Kimiuo lines up several shore bearings and drops his anchor directly over the ship's funnel. As we slip into the water, a school of Pacific barracuda parts into two groups to make way for our descent. We follow the anchor line into the clear blue water and descend upon the great ship's smoke stack at the 90 foot level. From there, we follow Kimiuo toward the stern cargo hold where he points out three magnificent field artillery cannons mounted on wheels. Still lashed to the stern deck, the gun barrels point up toward the surface. They are draped in a marvelous collection of sponges and soft corals. Further along the deck we find two huge gun barrels for shore battery installations. They are giant cannons, 12 to 15 feet long. The wreck is a three-ring circus of fish action. A large school of jack sloop down upon us like a squadron of fighter planes; still another group of unidentified fish circle us in Indian fashion.

With time growing short, Kimiuo leads us to the ship's bridge where we photograph the compass, the engine telegraph and other navigational equipment. Everything is still intact and we sense the unique thrill of diving a virgin shipwreck. It is the adventure of a lifetime, but it is time to go.

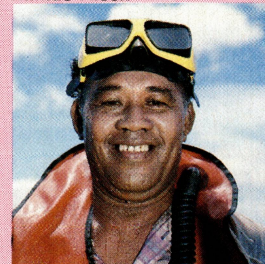
Kimiuo schedules a two and one-half hour surface interval before our next dive. We must burn off our residual nitrogen if we are to make another wreck dive at even a medium depth. Between dives we visit an abandoned Japanese Com-

Blue Lagoon dive boat



photograph by Paul Tzmoulis

Kimiuo Aisek



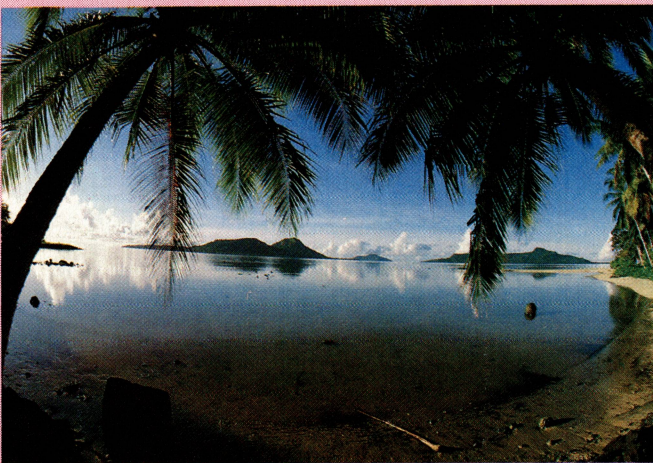
photograph by Geri Murphy

Truk Continental Hotel



photograph by Geri Murphy

View of Truk Lagoon from hotel balcony



photograph by Geri Murphy

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guam

mand Post on Eten Island, snorkel around two Japanese fighter planes lying in four feet of water, and lunch aboard the boat. For our afternoon dive we visit the wreck of the *Shinkoku Maru*, a 500 foot long fuel tanker sitting absolutely upright in 120 feet of water. Because of her hazard to lagoon navigation, this ship's masts have been cut off ten feet below the surface. The ship's bridge is in 40 feet of water and the decks are at 60 feet.

The *Shinkoku Maru* is considered the most beautiful wreck in Truk Lagoon, and perhaps the most beautiful in all the world. The soft corals on her upper decks are even larger and thicker than those of the *Fujikawa*. There seems to be a greater variety of colors. In the bridge area the soft corals are a veritable jungle of marine life. Once again, we find clouds of silvery baitfish dancing before our eyes. A small school of stately batfish parade back and forth in front of the bridge, occasionally approaching the divers. There is not time to fully explore the *Shinkoku* but it leaves an indelible image of phenomenal beauty.

Truk Lagoon is a one-of-a-kind adventure which can be enjoyed and appreciated by everyone. You don't have to be a wreck diving enthusiast to get turned onto these magnificent sunken ships.

It is time to once again continue our journey westward. Reluctantly, and somewhat sadly, we board our Air Micronesia jet, for there is so much more that we have not yet seen. Down deep we know that we must come back to Truk next year for a longer visit. Flying time from Truk to Guam is approximately one hour and 20 minutes — a cool and comfortable flight. As we descend from our 35,000 foot altitude, we see before us a very large island with mountain ranges, ocean bluffs, rolling plains, and a few scattered stretches of barrier reef.

Guam is a strange dichotomy. It is not officially part of Micronesia. Guam is instead a U.S. Territory with the same status as American Samoa or the U.S. Virgin Islands. The main city of Agana is like a miniature Honolulu. There are four lane highways, a business district, heavy automobile traffic, luxury beach hotels and sight-seeing buses. There is a U.S. Navy base at Agana Harbor and a large Air Force base at the other end of the island. Since Guam is a duty-free port, it is a shopper's paradise. Visitors are allowed to purchase up to \$600 worth of merchandise and bring it back to the U.S. without customs tax. It is an excellent

place to shop for Vietnamese gold, Japanese china, Asian jewelry, Japanese stereo equipment, Swiss watches and clothing from Hong Kong.

Guam has a modern airport terminal with many flights coming in from the Orient. Guam is considered the crossroads of Micronesia because this is where Air Micronesia's East/West flights connect with the North/South flights. It is the end of the line for Air Mike's transpacific "milk run" and the place where you pick up the flight to Palau, Saipan or Okanau.

While Guam has a great deal of dive activity among local residents and military personnel, the quality of diving does not compare with either Truk or Ponape. However, Guam's waters are quite clear and the reefs are comparable to those that you might find in Hawaii. If you happen to be staying in Guam for a day or two you may want to give it a try.

Guam has a total of four dive shops with the largest being the Coral Reef Marine Center. This shop is located on the main road just outside Agana and it is a full service store complete with equipment sales, regulator repair and instruction. The air compressor facility consists of a Worthington 15 cfm compressor and an Ingersoll-Rand 7 cfm compressor. There are 75 rental tanks, 50 regulators and 50 sets of snorkeling equipment. The shop's primary business is scuba training and equipment sales. The owners

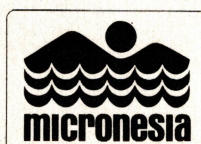


Shelling - Reefing - Wreck Diving

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As Executive Director for the Micronesia Regional Tourism Council I'd like to invite you to explore the underwater wonderland of Micronesia. However, there is as much to discover above the surface as below in each of the islands. If you want specific information on any of the Micronesian islands or general information about them all write to me:

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P.O. Box 682
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conduct a 45 hour PADI open water course and have five instructors giving lessons.

Most of the diving around Guam is beach and shore entries. Some of the more popular spots include: Gun Beach; Gab Gab Beach; Bile Bay; Piti Bomb Holes; and Nimitz Beach. Some of the better dives are further offshore and require a boat. These include the *Tokai Maru*, Tanker Wreck, Anae Island, Double Reef, Blue Hole, and the wreck of the *Cormorant*.

One of the nicest hotels is the Guam Continental. It is much different in design than the one in Truk; the rooms are located in individual bungalows spread out over the hotel grounds. All rooms are air-conditioned, beautifully furnished and some contain sunken Japanese style bathtubs.

palau

Palau Lagoon is located 800 miles southwest of Guam, just about as far west as you can go in Micronesia. The flight from Guam is only an hour, it is non-stop. However, the return flight is one hour, 45 minutes, with an intermediate

stop at the island of Yap. Once again we are winging our way to another adventure aboard Air Micronesia's 727 jet.

As the atoll comes into view we can see from the plane that Palau is a lagoon similar to Truk but its features are entirely dif-

ferent. It is a long narrow lagoon measuring 125 miles by 35 miles. There must be at least 250 miles of barrier reef encircling this tropical floating garden. Within the great lagoon are five large islands and 300 tiny ones. Nicknamed, "The Rock



photograph by Paul Tzmoulis

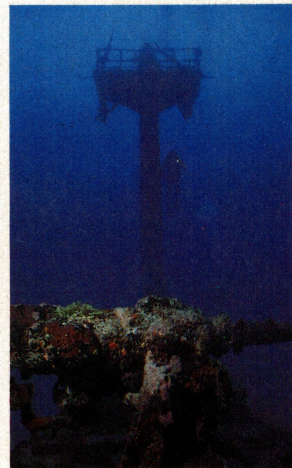
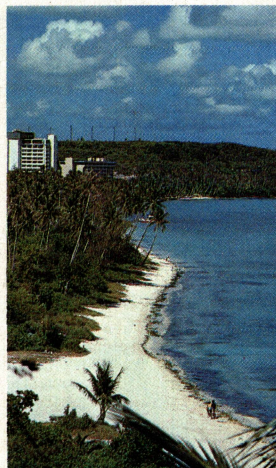


photograph by Gert Murphy

Soft corals on Siaes Drop-off, Palau

Giant deep seafan, Ngemelil Drop-off, Palau

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Islands," this group of unusual formations consists of coral rocks overgrown with dense jungle and with their edges undercut by sea level erosion. In between the tiny rock islands is a marvelous maze of lagoon canals and channels where power boats can cruise within an arm's reach of the islands.

Our plane lands at the airport on Babelthup, the largest island in the lagoon. The terminal is simulated Palauan architecture and once again jammed with local islanders. A bus from the hotel picks us up with many other new arrivals. We make a 45 minute drive from the airport, across a bridge between two islands and through Koror, the center of Palau's commercial activities.

The Palau Continental is similar in design and construction to the one in Truk except that it sits high on a hill overlooking the lagoon. It is a terraced affair with buildings on several levels. There are 50 rooms, all fully air-conditioned and equipped with small refrigerators for ice and cold drinks. Every room is beautifully decorated and has its own balcony facing the water. The lobby of the Palau Continental contains a reading room, small library, and a color video cassette television. Located in the same complex is a handicraft store (which sells ice cream cones), a cocktail lounge, and an air-conditioned dining room beautifully decorated with a giant coral sculpture and color photos by Douglas Faulkner. At the bottom of the hill is a hotel dock where boats pick up divers. Scuba gear and guests are transported from the hotel lobby to the dock via a small pickup truck. Hotel manager, Jimmy Makea, greets us, shows us around the hotel facilities and introduces us to the hotel's pet monkeys.

There are two dive operators in Palau — Fish-N-Fins Ltd. and the Palau Diving Center. Fish-N-Fins Ltd. is owned and operated by Francis Toribiong, who was born and raised in Palau but attended college in Long Beach, California for three years. He is an extremely energetic young man with a well-run organization and a sincere desire to provide enjoyable services for his guests.

The air station at Fish-N-Fins consists of an Ingersoll-Rand 15 cfm compressor and 14 240 cu. ft. storage tanks. Rental tank inventory includes 92 steel and aluminum scuba tanks. Fish-N-Fins also has a small inventory of regulators, BC's and other accessories, but visitors are encouraged to bring their own personal dive equipment. While Francis is a certified NAUI instructor, he prefers catering to experienced divers who know what they are doing.

Fish-N-Fins maintains a fleet of three dive boats. The largest is a 28 ft. custom skiff powered by twin 235 hp Johnson outboards. This boat can carry 12 divers and cruise at 35 mph. He has a 19 ft. custom built skiff powered by twin 115 hp Johnson outboards. This craft can carry six divers and also cruises at 35 mph.

There is also a 23 ft. skiff powered by a 140 hp Johnson which can carry five divers and cruise at 30 mph. Since most of the dive sites are 15 to 30 miles from the hotel it is necessary to use small, fast boats to make the trip as quickly as possible.

The dive trips generally depart at 9:00 am and are a full day. A two tank dive trip costs \$45, and a single tank dive trip is \$30. Fish-N-Fins also offers a single tank night dive which departs at 5:30 pm and costs \$30.

The Palau Diving Center, located in Koror, is owned and operated by Johnny Kishigawa. Johnny was born in Palau and went to school in Japan. Because he speaks fluent Japanese, Johnny primari-

the drop-off actually comes to a sharp point and 100 feet below is a very large tunnel which begins on the south side of the wall, cuts directly through the point and comes out on the opposite side. The top of the wall begins at 20 feet, and drops straight away into the deep blue. We are immediately confronted with a tremendous amount of fish activity, as great schools of fish pass by the point in one formation after another. The face of the wall is festooned with brightly colored formations of soft coral: reds, yellows, blues and so on. We descend admiringly once again, wishing we could stop and photograph each and everything we see.

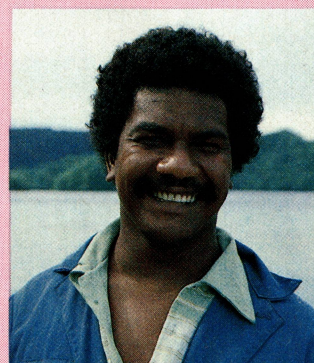
At 90 feet we encounter the upper lip of the tunnel entrance. It is a giant yawning



Palau Continental Hotel



Fish-N-Fins dive boat



Francis Toribiong

photographs by Geri Murphy

ly caters to Japanese dive groups and occasionally, American visitors.

The Palau Diving Center has a Bauer 9.2 cfm compressor and ten 240 cu. ft. storage cylinders. There are 65 steel rental tanks and approximately a dozen sets of snorkeling gear, regulators and BC's. The shop maintains a fleet of dive boats. The largest is a 25 ft. custom skiff which can carry eight divers. The other two boats are 15 ft. skiffs which can carry up to three divers each. There is a two tank dive for \$45 (\$55 if lunch is included). The boat departs at 9:00 am and is considered an all day trip. There is also a single tank night dive which departs at 6:00 pm and costs \$35.

At breakfast the next morning we meet Francis in the dining room to plan our dive trip. First, we will go to some of the furthest and best reefs at the south end of the lagoon, 30 miles from the hotel. Since the weather is good we should make the trip in less than an hour. Francis' prediction is correct and we anchor over Siales Drop-off a little after 10:00 am. This site is a special combination wall dive/underwater tunnel exploration because of an extremely unusual formation. Siales Drop-off is on the western side of the Palau barrier reef at a point where the reef makes an abrupt right angle turn. The edge of

cavern in the side of a wall, big enough for a full-sized subway. The bottom of the tunnel is approximately 130 feet down. With lights turned on we begin our swim along the horizontal corridor. The interior walls of this great passage are filled with large black coral trees, deep seafans, and a fantastic array of soft coral. It is like entering a fantasy world where everything is larger than normal. The tunnel is perhaps 150 feet long, but halfway through our attention is diverted to a side window which opens onto the vertical drop-off. Here we discover a brilliant orange seafan eight feet tall. At the base of its branches we find a pure white soft coral — the two color combinations are breathtaking. Nearby are other spectacular formations of purple soft corals, red seafans and black coral trees. The sight is spellbinding.

With our bottom time almost exhausted, we continue our journey along the tunnel corridor and emerge on the opposite wall. Our ascent is a slow diagonal swim while we photograph one colorful soft coral after another. The marine life on the face of this wall is exquisite and we have soon exhausted the film supply in all of our cameras. Our first wall dive in Palau is going to be hard to beat, for it is drop-off diving at its absolute finest. In

fact, it is so good that we hurry back to the surface so that we may decompress and perhaps return for a second dive.

The next day Francis and his expert guides take us further south to a very special drop-off called Ngemelis: Reputed to be the finest wall dive in the world. Situated close to the south end of Palau lagoon, this site takes approximately one hour, 20 minutes to reach by boat, but it's worth the long ride. The top of the wall begins at a depth of two feet! In fact, parts of the coral reef actually stick out of the water at low tide. The wall drops vertically from two to 1000 feet and is covered with an incredible array of seafans, sponges and corals. Ngemelis offers some of the most outstanding examples of exotic Pacific seafans to be found anywhere in Micronesia. They range in color from crimson red; to strawberry pink; to bright yellow; to flame orange. Soft corals grow from every ledge, crevice and clump, with every conceivable color in the rainbow. We pause momentarily at 80 feet to photograph a raspberry colored soft coral and then move onto a brilliant yellow fan. Our dive is a trip through a wonderland of colors. It seems as though every species of Indo-Pacific marine life has been crammed into this one mile stretch of spectacular drop-offs. With our air tanks running low, we move up into the shallow ten foot zone to photograph colorful tridacna clams, schools of damselfish, friendly clownfish in their anemones, and a hundred other little creatures. The diving is breathtaking and we wish that we could spend at least three days exploring this marvelous reef.

With cameras barely reloaded, our dive boat speeds north along the eastern side of the barrier reef to a newly discovered wall called Denges Drop-off. The top of the wall includes a sprawling coral plateau in 35 feet of water, covered with a magnificent array of giant tabletop corals. Visibility along the edge of the drop-off is super clear and we watch a manta ray swim toward us from 150 feet away. The sight is magnificent as this creature, with a 12 foot wingspan, soars over our heads and turns toward the open sea. At a depth of 80 feet we find a large soft coral in a magnificent electric blue. Nearby are more giant fans and towering trees of black coral.

The number of dive sites at Palau Lagoon is staggering. Few places on earth offer such an incredible variety of dive experiences in such a concentrated locale. There are at least 60 identified drop-offs where the quality of diving is considered superb. There are also at least a dozen blue holes located along the southwest section of the barrier reef and perhaps many more in still-uncharted areas. Inside the lagoon, a number of shallow water reefs offer a rare opportunity to see and photograph the giant tridacna clams. Some of these mammoth mollusks measure six feet across and weigh in excess of 1000 pounds. Right off Koror is a fabulous underwater cave system

MICRONESIA



TRUK	\$488.00 per diver	RATES INCLUDE: Room based on dbl. occupancy; diving 2 tanks per day by boat with guide; use of weights, weightbelt, tank and backpack; hotel room taxes in Truk and Ponape; roundtrip airport transfers; and a full day island tour on Ponape. Airfare not included. Sgl. occupancy and non diver rates are available.
7 nights/6 days diving		
PALAU	\$476.00 per diver	
7 nights/6 days diving		
PONAPE	\$280.00 per diver	
5 nights/3 days diving		



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with five connecting chambers and white crystalline stalactites hanging from the ceiling. Several of the larger rock islands contain inland saltwater lakes which connect to the lagoon through underwater tunnels. These marine lakes contain extraordinary and rare species of marine life not known to exist anywhere else on earth. One drop-off, called Shark City, provides high voltage dive action and an opportunity to photograph gray reef sharks at close range. In addition to the unusual and incredibly beautiful marine life, there are at least four large Japanese shipwrecks, dating back to World War II, sunk in the lagoon. A Japanese zero

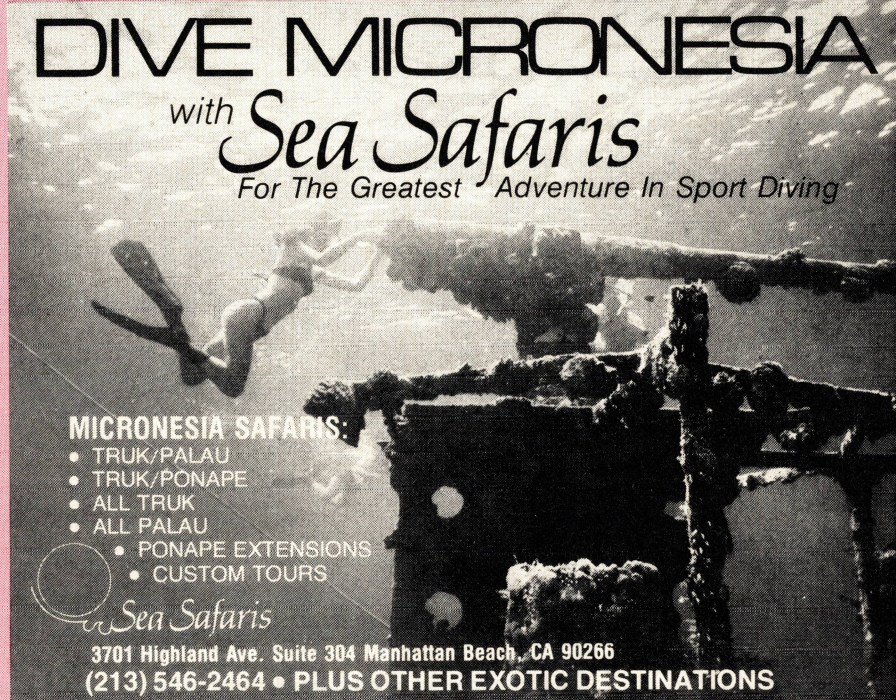
south of Koror can be found and photographed in only five feet of water. If that is not enough, you might try your luck at photographing saltwater crocodiles, sea snakes, and dugongs. Although shy and retiring, all of these rare creatures can be found within Palau lagoon.

If you had to choose the best all-around dive spot in the world, Palau would certainly be a top contender for the title. One day of diving in this remarkable lagoon is equal to 20 dives at almost any other top notch dive location in the world. The quality of diving is absolutely superb, and it is a fitting climax for the end of our Micronesia odyssey. 🐠

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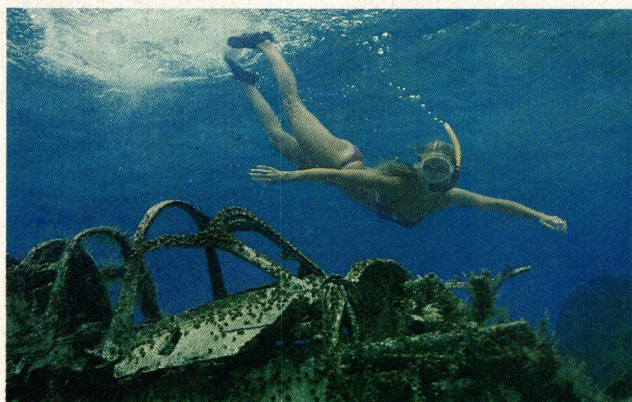
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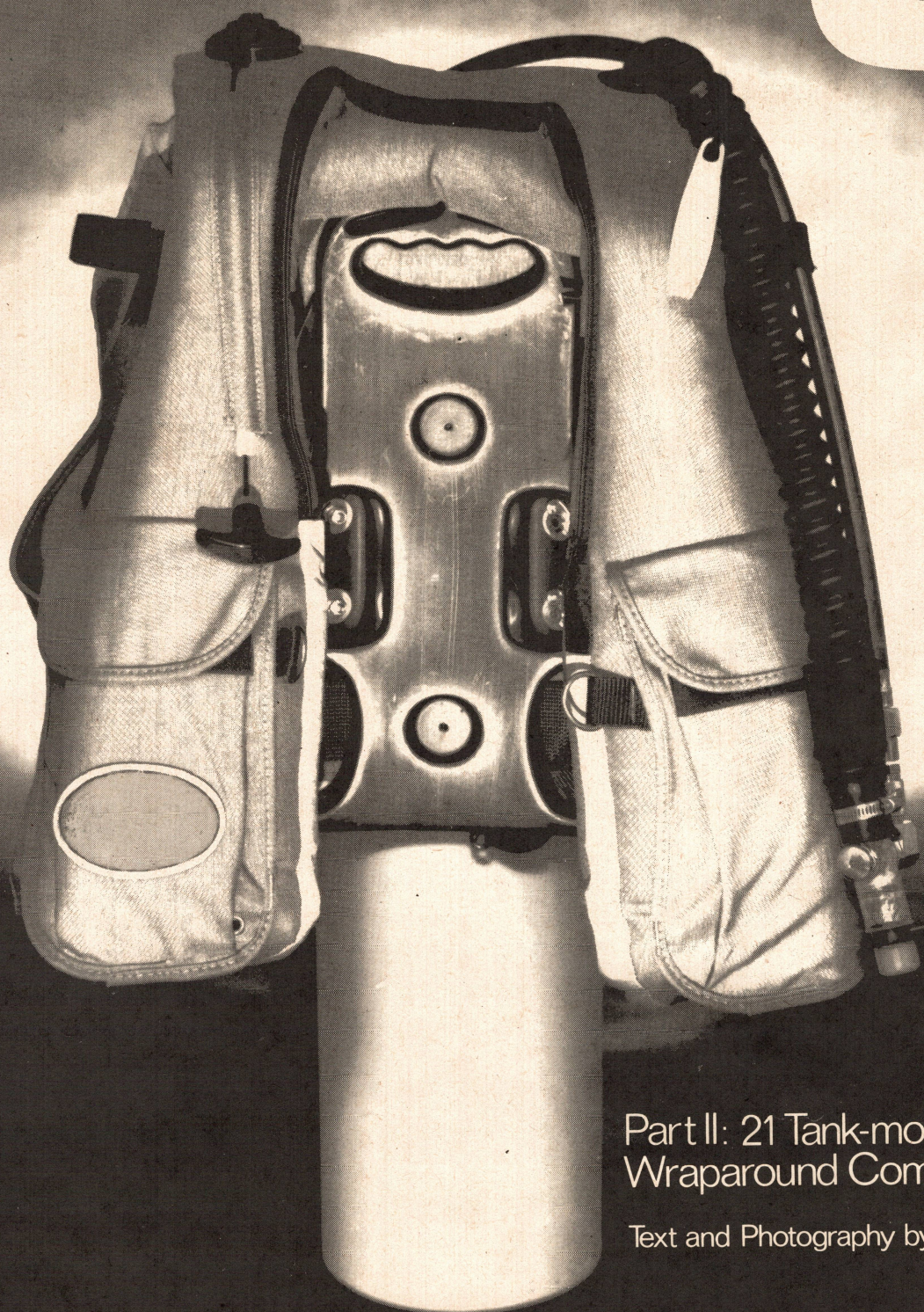
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CONTINENTAL
AIR MICRONESIA

SK-11

BC roundup



Part II: 21 Tank-mounted and Wraparound Compensators

Text and Photography by Marty Snyderman

BC

roundup



Cressi-Sub, 750



Dacor, CVB



Dacor, Seachute Jacket, BCSL, BCSM

In the October issue of SKIN DIVER, we began a two part equipment roundup of buoyancy compensators. We reviewed some of the more commonly accepted sport diving techniques which involve the use of any BC, and then took an in-depth look at horseshollar BC's. There is, however, much more to consider in order to complete this review. Keeping in mind that BC's have been accepted as a standard piece of dive equipment for less than a decade, it is rather astonishing to see the variety of styles and options offered to today's divers. The overwhelming acceptance of the use of some type of compensator had led to radically new developments and the utilization of both back BC's and the even newer jacket and wraparound units. The term, tank-mounted buoyancy systems refers to all three of these styles, and in this issue we will take a look at those models and some new diving techniques which have been developed to take advantage of their design.

While most instructors are totally in favor of the number of BC's offered to the public, it is only honest to add that there is considerable debate within the diving community concerning the features needed on the various models as well as the correct techniques for use. A factor that adds some fuel to the fire in these debates is that with the development of the new styles of equipment, BC's and tank harness systems have become increasingly integrated and it has, therefore, become more and more difficult to consider any given piece of dive equipment apart from the rest of the system.

A review of BC's should consider not only the features found on them, but must also analyze the more hotly debated issues as to how divers should properly weight themselves, how an octopus second stage should be mounted, and the even more controversial issues of the proper technique and equipment needed for buddy breathing.

For many divers, especially those new to the sport or those who have not been active in recent years, all of this can be unnecessarily confusing. It is not within the scope of this article to try to resolve the issues, nor is it valid for me or anyone else to declare that any one style of BC and any particular technique is best for all divers in all dive conditions. It is the purpose of this piece to inform you about the BC styles available today,

their use, and to help you decide which style is best suited to your needs.

THE ALTERNATIVES

Only in the last half of the 1970's did many manufacturers begin to offer alternatives to the horseshollar compensators. Back BC's were the first possibility to be thoroughly explored and only in the past two or three years have the jacket and wraparound styles been produced. Three or four years ago back-mounted BC's were divided into the categories of hard shell or soft packs, but with the demise of hard ferrings and the development of jacket and wraparound BC's, a more valid division at the present time is into the categories of back BC's and jacket BC's.

BACK BC'S

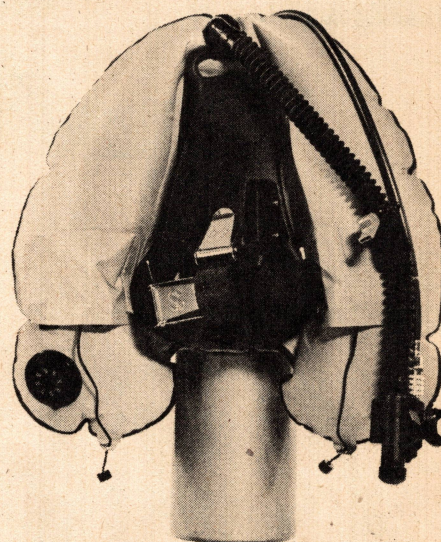
Back BC's, often referred to as back buoyancy packs or back units, are different than horseshollar compensators in several respects. These units are at-



Scubapro, Stabilizing Jacket,
21-028-200—21-028-500



Parkway, VES 31223—31252



Scubapro, Buoyancy Control Pack,
21-021-000

tached to the diver's backpack and are worn behind the diver rather than in front, on the diver's chest. The inflatable bag is shaped like a horseshoe, is mounted in most cases on the band of the backpack, fits between the backpack and the tank, and conforms to the shape of the tank. In all back units the inflator/deflator hose comes over the diver's left shoulder.

Back compensators are made available to consumers in a variety of ways, the sum of which makes it easy to begin your total diving system with a back BC or to convert to a back unit if you already have a horsecollar compensator. Some manufacturers supply their units as an inflatable two bag system with an oral inflator, while others add a power inflator to their basic systems. Some packages include the option of a cam style backpack or at least the addition of a Velcro strap that is attached to the back of the BC. This strap serves to hold the tank in place when the system is in use and like any other cam band, allows you to easily and quickly change tanks after a dive. The addition of a backpack and strap system is, however, necessary to attach the tank to the diver. When trying to compare the advantages of the features offered with the price of any given BC, it is wise to know whether the package you're considering includes a backpack and/or inflator system.

MOUNTING

To mount a back BC to a tank, simply fit

the bands from the tank backpack through two slots in the BC and, tightening the band around the tank, secure both the tank and the compensator. For divers who already have a backpack of their own or who already own a back compensator and are planning a dive vacation to some faraway paradise, it is nice to know that all of the back BC's that come without a backpack of their own can be mounted on almost every standard, single tank backpack now on the market. If you have an older backpack that is in good condition and would like to consider using a back BC, take the backpack with you to your dive shop and test it to see if the compensator can be used with it. The critical factor will probably be the width of the tank band and the size of the slots in the compensator.

CONSTRUCTION

The materials used in the construction of the various back BC's are similar in nature to those of horsecollar BC's. Most

back compensators are two bag systems, with an outer bag encasing an inner bladder. The outer covers are made of a pliable, yet very durable fabric such as the ballistic nylon employed by Dacor, the 420 denier nylon used by Sequest, and the armornyl used on the Sportsways model. The bladders are generally constructed from an electronically sealed polyurethane; a heat sealed, urethane backed nylon twill; or a vinyl coated nylon. Don Rockwell of Sequest recently told me that, "All the manufacturers presently using nylon twill will soon be going to the new polyurethanes." All of the bladders are literally impossible to tear, wear resistant, difficult to puncture, and not likely to leak unless they are grossly misused. It is, however, important to follow manufacturers' instructions and rinse salt water out of the bladder to prevent a buildup of salt crystals which in time could cause it to harden and crack. Although it is not likely that bladders will need to be repaired or replaced, all of them can be easily removed via the zippered opening in the outer bag. Some bladders can be repaired in the event of minor leaks and all can be replaced at a reasonable cost. An excellent feature on all of the two bag back-mounted BC's is the use of wide mesh drains on the bottom of the cover which allow water to escape after a dive. In addition, all also have either a mesh drain or several grommets in the top of the cover to allow what would otherwise be trapped air to escape during

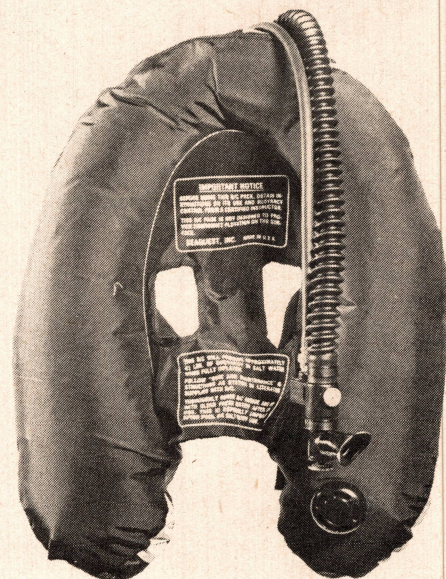
BC roundup



Seaquest, Sea Jacket, 9260-9263, 9070-9071



Scubapro, Universal Stabilizing Jacket, 21-047-200—21-047-500



Seaquest, B/C Pack, 9488—9489

today's BC's are such that the over-pressure relief valve can vent off air as fast as the BC can be inflated, even when using a low pressure power inflator. It is considered wise by most instructors to have the valve located someplace relatively low on the vest so that in case the valve leaks, all of the buoyancy will not be lost by the diver.

Several manufacturers include a dump valve along with an over-pressure relief valve in their back BC's. Dump valves, unlike over-pressure relief valves, are manually operated by pulling a toggle cord or by tilting or pulling a valve stem. They enable a diver to quickly vent the air from the BC in order to avoid making too rapid an ascent, or to quickly begin a descent. While a dump valve is considered by many instructors to be an excellent feature, it is true that on back compensators you cannot see the manual release and must locate and operate the valve by feel. Being able to immediately find the release is necessary because excess air usually needs to be vented rapidly. Dump valves are also beneficial to divers who cannot easily get a hand up high enough to vent air off in the conventional manner — as might be in the case of a photographer with a handful of equipment. In order to vent air off, the opened valve must be in a higher position than the air in the bladder. On back BC's this requires divers to lie on their backs or to roll to one side in order to elevate the valve. Neither technique is difficult to learn but one must practice the maneuvers.

descents — a useful innovation.

Scubapro prefers to use an airtight, one bag system constructed out of a neoprene backed 420 denier nylon, with all seams lapped and double-taped for strength and durability. The Scubapro bag, unlike that of all other manufacturers, is attached to the backpack by a plate and six bolts which hold both the compensator bag and the tank band securely in place.

FEATURES

As in all horseshollar and jacket style compensators, back units come equipped with an over-pressure relief valve. These are made of a one-way spring-loaded flapper design and are constructed to give when the internal pressure is somewhere between two and three and one-half pounds per square inch above ambient pressure. Their function is to prevent the bladder from rupturing if over-filled or when gases expand during an ascent. The designs on all of

Tank-mounted BC's, both back units and the jacket styles, are subject to chafing in the area where the compensator comes in contact with the tank on one side and the backpack on the other. A good feature to look for in any tank-mounted BC is a reinforced, rubberized mounting pad that will resist wear. This feature is especially beneficial to divers who need to travel a long way with all of their equipment in place.

DEVELOPMENT

The two most important factors that led to the development of back BC's were the desire to eliminate both the bulk of a horseshollar BC in front of a diver's chest, and a set of straps. Both hopes have been realized and many instructors consider these factors to be tremendous strides forward in diver comfort and convenience. Eliminating the bulk not only makes swimming on the surface easier and more comfortable, but it also makes breathing much easier as there is less re-



Seaquest, Delta BC, 9498-33—9499-33



Seaquest, Sea Jacket III, 9080—9083



Seaquest, Sea Jacket II, 9050-9053

striction in the chest and throat when inhaling. Not only has a strap system vanished, but back BC's do not necessitate the use of a crotch strap. Though crotch straps do help secure some compensators, they are considered by many divers to be both unnecessary and uncomfortable. Additionally, one less strap means that weightbelts are much less likely to be mismounted or get hung-up when dropped in emergency situations.

DONNING TECHNIQUES

The entire process of getting dressed is more convenient and faster with tank-mounted BC's. It is no longer necessary to adjust both your BC and tank after getting into your wetsuit. Instead, you can quickly mount your back BC to your tank before getting into your suit, which means less time getting overheated on the surface. Once you put the pack on, the simple act of bending over and cinching up the waist strap is all that is required to adjust the entire harness system. When submerged it is often a good idea to again tighten the waist strap in order to prevent tank-sway, caused by the compression of your suit at depth.

There are several ways to don a back BC system. If you are the more muscular type, you can put the unit on by standing behind the tank, inserting your arms through the shoulder straps, and then lifting the tank over your head and easing it into place on your back. Another method is to sit down and slip into the already buckled shoulder straps one arm at a

time. Some commercial dive boats have tank racks that allow divers to use this technique while standing rather than sitting.

When diving from small boats, in calm and relatively current free seas, it is also possible to don a tank-mounted BC in the water rather than on the boat. Doing so is easy, but does require some practice in a pool. In the water you can pull the inflated system on over your head, or back into it and put it on one arm at a time much like you would a coat. A word of caution: Make sure that your BC is fully inflated, will float everything attached to it, and is not leaking before placing the system into the water — more than one diver has jumped into the water to put on his gear only to look down and see it resting on the bottom. While many experienced divers truly enjoy the ease and convenience of donning the system in the water, the techniques employed are quite controversial according to many instructors, because they believe it is unsafe to enter

the water with your weightbelt on if you are separated from your buoyancy system. Other instructors maintain that in-water donning is okay as long as you are always in contact with and in control of your BC. Still others recommend being weighted a little light on the surface. This of course makes foot-first descents more difficult and clearing is easier when descending foot first. All the instructors I spoke with agree that trying to put your weightbelt on after donning the system on the surface is difficult to do, especially if you have a handful of accessories such as cameras or spearguns.

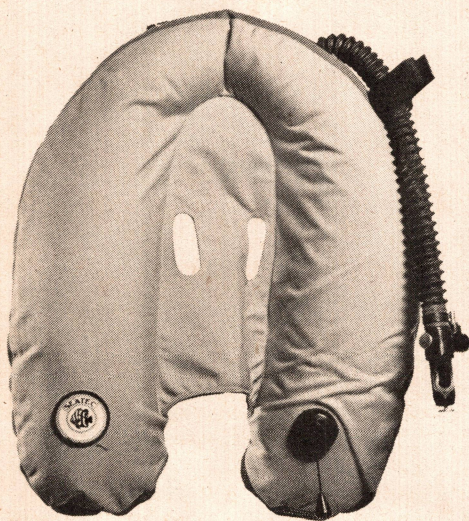
IN THE WATER

It is on the surface and underwater where the biggest advantages of tank-mounted compensators are realized. These compensators are designed to allow you to surface swim on your back as well as your stomach. When back BC's are inflated, they enable you to ride high out of the water when resting or swimming on your back. In fact, you can ride so high above the surface of the water that it is very easy to carry on a conversation and there is no need to use your snorkel. The air pocket behind your neck, in a properly fitting back BC, will gently support your head so that swimming on your back is quite comfortable. Without a doubt, it is easier to become oriented to surface conditions the higher you are out of the water, and too, there is less anxiety experienced and water swallowed.

If you want to take a look at bottom ter-

Bc

roundup



Seatec, Seahorse, 10371-19



Seatec, Bluefin, 10323-01



Selpac, Buoyancy Control Pack, SBC 52LP

pieces of equipment often involves different techniques with a back BC as opposed to a horseshollar because the hoses occasionally get hung up between the inflated bag and the tank. By simultaneously dipping your right shoulder and reaching back with the right hand it is possible to free and find your second stage, and a similar motion with your left side will enable you to find your pressure gauge and inflator hose. This task, though easily performed, is considered to be an unnecessary inconvenience by some manufacturers so they have added Velcro hose guides through which your second stage and pressure gauge can be threaded. These guides will usually cause the hoses to drape conveniently over your shoulders and they will be in front of you at all times. Nevertheless, it is a good idea to practice finding all of your gear in case you forget to thread the hoses.

Tank-mounted BC's can be vented from either a facedown or faceup position. A critical factor in venting back compensators concerns the positioning of the deflator hose on the bladder. If the hose is connected to the side of the BC toward the diver's back, it is much easier to vent from a headup position — the diver leans slightly backward to force the highest pockets of air to the deflator outlet. From a facedown position, even if the deflator hose is held sufficiently high above the inflated compensator, a significant amount of air might not be able to

escape from the bladder if the outlet at the bladder is at a point lower than the air trapped inside the bag. It is, however, much easier for many divers to control their bodies when descending face first rather than when leaning backward. To alleviate this problem several manufacturers now attach the deflator high on the opposite side of the compensator so that it is much easier to place the bladder outlet at a point higher than the air inside from both a facedown or faceup position — a feature many divers strongly favor!

Once underwater, tank-mounted BC's help divers achieve a comfortable position. Swimming underwater is much easier in a slightly head up/feet down angle of about 20 degrees, and this is readily achieved with back BC's because they provide a high center of buoyancy while your weightbelt provides a low center of gravity. The air inside the compensator will tend to lift the weight of the tank off of

rain or if you simply prefer to swim on your stomach, you can roll over, and using your snorkel, be on your way. Gone is the discomfort of having an inflated front vest ride up under your chin and restrict your breathing. Also missing is that feeling of trying to balance yourself on top of your vest when swimming on your stomach, which means greater comfort and less seasickness.

When changing from your back to your stomach, it is best to roll one shoulder over the other as opposed to trying to lever yourself forward by kicking and pulling your head forward into the facedown position. Beware that although the levering method appears simple, it can overstress hamstring muscles and even cause leg cramps.

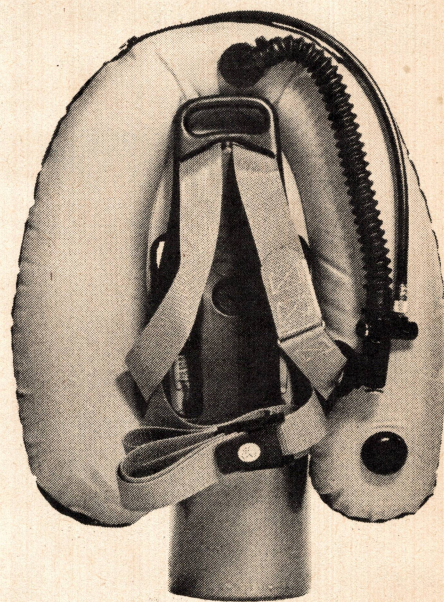
It is always a good idea to insert your second stage into your mouth before descending and to locate your console and inflator/deflator hose. Finding these



Selpac, Oceanaut, SBC 70



Selpac, Oceanaut, SBC 75



Sportsways, Hydronaut, 4020

the scuba diver's back.

All the back units included in this review have at least 30 pounds of lift. While that much lift enables the BC to float your head high above the surface, it can lead to a diver making an uncontrolled ascent if the diver over-inflates the bladder or the air expands faster than expected during an ascent. While the principles for ascending are the same with all types of compensators, locating the deflator from any position underwater and being able to get the hose and the bladder connection up high enough to vent off excess air is a skill that needs to be mastered.

On the surface after a dive, a tank-mounted BC provides an excellent resting platform. If you desire, you can slip out of the inflated system and rest unencumbered on top of it as you leisurely kick back to the beach or boat, but keep in mind that you will probably be wearing a weightbelt and not a BC if you employ this technique. The same would be true in the case that you return to your boat, remove your BC system, climb in, and pull the unit in after you; but entering a boat in this manner is a convenience some divers use almost every time they dive. In any case, getting out a back compensator harness is extremely easy — undo a shoulder strap, then a waist strap, and slip out of the gear.

POSSIBLE DISADVANTAGES

Without question tank-mounted BC's add a great deal of comfort and conven-

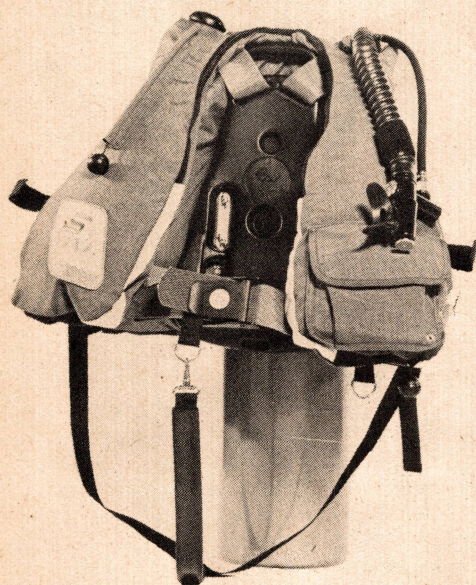
ience for many divers, but they are not totally without some disadvantages. The most obvious disadvantage is that a back unit, even if fully inflated, will not float an unconscious diver faceup on the surface. And because of this, the value of a CO₂ inflator in some emergency situations is reduced. Some instructors counter that potential drawback by pointing out that back BC's do provide an ideal platform on which to give mouth-to-mouth resuscitation: If the buddy system is being practiced and the divers know how to give mouth-to-mouth, the question is more of a philosophical issue than a real issue. When first using a back BC, some divers complain that the air tends to shift from side to side when they change positions underwater, giving them the sensation that their compensator controls them more than they control their compensator. Divers who prefer the back BC's are quick to point out that the

situation is quickly overcome and merely requires a little balancing, about the same as riding a bicycle. Another possible disadvantage is that if a diver's tank becomes hopelessly entangled underwater and the diver bails out of the system, he or she will also be giving up the compensator as well. Additionally, it is difficult to spot leaks in back BC's because the unit is located behind the diver's field of view. Some divers complain that you lose pockets as well as accessory rings when you employ a back BC, while others state that pockets can be added to most wetsuits easily enough and accessory rings can be added to straps. Some divers point out that you must disassemble your equipment, removing your tank and regulator, if you wish to use a back compensator while free diving after a scuba dive, and they add that back BC's are often wider than front vests and therefore create more drag.

JACKETS

The latest style of compensator to enter the diving scene is usually referred to as the jacket, or wraparound style. Some people use the words jacket and wraparound interchangeably, while others try to distinguish between those categories. In this article, I will refer to all of those compensators as jackets, with one exception, which will be called a wraparound. To many, jacket BC's represent the highest achievement yet at-

BC roundup



Sportsways, Mini-Jac, 7500, 8100



U.S. Divers, Sea Otter I, 7776-00—7777-00



Tabata, SDJ, 740

tained in BC's. The jacket design combines many of the best features of front and back buoyancy devices, as well as offering a few advantages unique to its own creation. Jacket BC's provide the ease and comfort of back flotation and back swimming while on the surface, as well as the faceup flotation produced by horsecollar BC's in emergency situations. And underwater, the unique design gives divers lift in areas where they need it most, when they need it, because the air is free to move about within the bladder due to the open, one-piece design.

DESIGN AND CONSTRUCTION

Like back BC's, jacket BC's are back-mounted systems that either attach to the band of any currently made single tank backpack, or come already attached to their own backpack. They provide lift on the diver's back, behind the head, above the shoulders, in front of the chest, and in

some cases underneath the diver's arms on the side of the body. Most jackets do not have buoyancy panels under the arms, but instead connect the front of the jacket to the back under the arms via a flat nylon side panel or a nylon strap attached to two D-rings. Many models are offered without tank shoulder straps as the bag itself has become an integral part of the harness system. The arm holes in the jacket take the place of the shoulder straps and thus another set of straps has been eliminated. On models that employ this design, the only strap a diver needs to deal with in order to adjust his entire tank and buoyancy system is a waist strap, and in some cases a small chest strap that connects the front sections of the bag to each other. The waist strap is threaded through or connected to both the backpack and the compensator and secures both the pack and jacket to the diver's body. The wider surface area of the bag, as compared to the traditional shoulder straps, distributes the weight over a larger area of your body. No shoulder straps means there is nothing to bite into your shoulders or to wear-out your suit.

While some divers prefer the comfort and convenience of the almost strapless jacket style BC's, others feel they need the added security and control provided by shoulder straps in order to prevent their tank from shifting. Shoulder straps also help to reduce stress on the compensator bag. Sportsways and Tabata

have responded to those desires by supplying their jackets with a single continuous strap that serves as both a shoulder and waist strap. The strap threads through the backpack in exactly the same manner as a conventional pack and follows a pattern that takes the strap through a series of nylon guides on the inside of the jacket as it goes over the arms, through the pack, along the waist of the jacket to the waist buckle. The single strap design allows the diver to bend over and with one pull cinch down the entire system. Cressi-Sub, Parkway, Seaquest and Selpac provide the option of using their jackets with or without shoulder straps. My personal observations have shown that many barrel chested men do not need the shoulder straps while those with slimmer builds prefer to use them. In addition, some manufacturers provide optional crotch straps because on some divers the jackets have a

Wraparound & Tank-mounted BC Roundup

MANUFACTURER	NAME/MODEL NO.	STYLE	NUMBER OF BAGS	BUOYANCY	POWER INFLATOR	BACKPACK/BANDS	DUMP VALVE	MOUNTING AND HARNESS SYSTEM	EMERGENCY DEVICES	COLOR(S)	RETAIL PRICE
Cressi-Sub	Bac Pac, 745 750	Back Jacket	2	40FW	Yes	Optional	No	Mtasbp	25gmCO2	Blue/orange	\$116.00
			2	44FW	Yes	Optional	Yes	Mtasbp, shoulder strap guides, crotch strap		Blue	210.00-230.00
Dacor	CVB BCSL, BCSM	Back Jacket	2	37FW	No	No	Yes	Mtasbp	Whistle, 25gmCO2	Orange/black	\$ 99.00
			2	44FW	Yes	Optional	Yes	Mtasbp		Blue, orange	238.00-270.00
Parkway	Pro/VES 31223, VES 31252	Jacket	2	44FW	No	No	Yes	Mtasbp, crotch strap	25gmCO2	Blue, yellow, multi-color stripes	\$184.00
			2	35FW	No	No	Yes	Mtasbp, crotch strap		Yellow/blue	178.78
Scubapro	Buoyancy Control Pack, 21-021-000 Stabilizing Jacket, 21-028-200—500 Universal Stabilizing Jacket, 21-047-200—500	Back	1	35FW	***	Yes	Yes	Shoulder, waist straps	Whistle, 2 CO2 mechanisms	Orange	\$220.00
		Jacket	1	30, 40, 50, 80FW	***	Yes	Yes	Waist strap		Orange	255.00
		Jacket	1	30, 40, 50, 80FW	***	No	Yes	Mtasbp, waist strap	Whistle, 2 CO2 mechanisms	Orange	200.00
		Jacket	1	30, 40, 50, 80FW	***	No	Yes	Mtasbp, waist strap		Orange	200.00
Seaquest	B/C Pack 9488, 9489	Back	2	41SW	Optional	No	No	Mtasbp	25gmCO2 optional	Black & yellow	\$110.15-133.90
	Sea Jacket 9260-9263, 9070-9071	Jacket	2	38, 46SW	Yes	No	Yes	Mtasbp, crotch strap, shoulder, waist strap guides		Blue & yellow	225.15-239.70
	Sea Jacket II, 9050-9053	Jacket	2	38, 46SW	Yes	No	Yes	Mtasbp, crotch strap, shoulder, waist strap guides		Yellow, blue & yellow	221.05-248.80
	Sea Jacket III, 9080-9083	Jacket	2	38, 46SW	Yes	No	Yes	Mtasbp, crotch strap, shoulder, waist strap guides		Blue & yellow	240.40-255.00
	Delta B/C, 9498-33—9499-33	Wrap-around	2	38SW	Yes	No	No	Mtasbp, crotch strap, waist strap guides		Blue & yellow	195.00-207.50
	Seahorse, 10371-19	Back	2	45SW	Yes	Optional	Yes	Mtasbp		4 color combinations	\$ 99.00-173.00
Seatec	Baby Bluefin, 10354-01	Jacket	2	35SW	Yes	Optional	Yes	Mtasbp, waist strap	25gmCO2	4 color combinations	198.00-275.00
	Bluefin, 10323-01	Jacket	2	45SW	Yes	Optional	Yes	Mtasbp, waist strap guides		4 color combinations	198.00-275.00
	Bluefin, 10323-01	Jacket	2	45SW	Yes	Optional	Yes	Mtasbp, waist strap guides		4 color combinations	198.00-275.00
Selpac	Buoyancy Control Pack, SBC 52LP	Back	2	42SW	Yes	No	No	Mtasbp	25gmCO2	Blue/yellow	\$139.00
	Oceanaut, SBC 70	Jacket	2	35SW	Yes	No	Yes	Mtasbp, optional crotch strap, shoulder, waist strap guides, 2 position waist belt		Blue/yellow	198.00
	Oceanaut, SBC 75	Jacket	2	44SW	Yes	No	Yes	Mtasbp, optional crotch strap, shoulder, waist strap guides, 2 position waist belt		Blue/yellow, orange/black	217.50
Sportsways	Hydronaut, 4020	Back	2	40FW	Optional	Optional	No	Mtasbp	26gmCO2	Orange	\$103.00-162.00
	Sub-Jac, 6000, 7100	Jacket	2	45FW	Optional	Optional	Yes	Mtasbp, crotch strap		Blue/black	190.00-250.00
	Mini-Jac, 7500, 8100	Jacket	2	50FW	Optional	Optional	Yes	Mtasbp, crotch strap		Blue/black	195.00-263.00
Tabata	SOJ, 740	Jacket	2	35SW	Optional	Optional	Yes	Mtasbp, crotch strap	25gmCO2	Orange/black	\$190.00-250.00
U.S. Divers	Sea Otter I, 7776-00	Jacket	2	55SW	Yes	Yes	Yes	Mtasbp	Whistle, 38gmCO2	Yellow, blue	\$247.00
	Sea Otter II, 7776-80—7777-80	Jacket	2	43SW	Yes	Yes	Yes	Mtasbp		Yellow, blue	247.00

Mtasbp—mounts to any standard backpack currently on the market
SW—Salt water
FW—Fresh water

***Scubapro buoyancy systems are not equipped with a mouthpiece for oral inflation or with a mechanical inflator; Scubapro recommends the use of a Quick Disconnect Inflator, or an AIR II.

tendency to ride up too high when they are inflated on the surface.

FEATURES

The jacket style incorporates many of the extras found on other style compensators. Some jacket systems, like back BC's, come with their own contour molded cam style backpack, while most are supplied as a compensator without any pack at all. And, like back BC's, these units will fit onto any standard backpack, being threaded through the pack band. Many of the jacket units come with a low-pressure inflator and a CO₂ inflation mechanism, so that they can be filled in any of three ways: orally, mechanically via the low pressure inflator, and with CO₂ in emergency situa-

tions. There is little question that a CO₂ inflatable BC that will float an unconscious diver faceup on the surface is a step toward diver safety. All of the jackets floated me faceup when I tested them in a pool, but manufacturers warn that this might not be the case for all divers due to variations in physiques, the use of various weight systems and wetsuits, and a variety of water conditions.

All jackets have at least one pocket and some have one or more accessory rings to which lights, ab irons, and other small items can be attached. Octopus second stages can also be mounted to these clips in a variety of ways. Seaquest's Octapocket provides a totally different method for carrying an octopus, but beware, buddy breathing techniques

continue to be debated by instructors and included in the debates are questions involving the means of mounting an octopus, as well as whether a second stage should be given to the out-of-air diver.

Manually operable dump valves are a feature found on many jackets. Most manufacturers use the same valves on their jackets as they do on their other compensators, while Seaquest uses a Rapid Exhaust (R/E) Valve. This valve is located in the elbow assembly of the inflator hose and allows deflation by a simple downward pull of the hose. The advantage of having the valve incorporated into the inflator assembly, rather than into the over-pressure relief valve, is that there is one less control for the diver to lo-

BC

roundup

cate, and the inflator is easy to find. The positioning of dump valves on jackets continues to be a topic of discussion among instructors as they compare the advantage of a relatively high location with the disadvantage of valves that sometimes leak.

The materials used in construction of jacket BC's are the same as those used in top-of-the-line horsecollar and back compensators. Jacket BC's come in a wide selection of colors and the design is proving to be rugged. Basic maintenance of jackets is the same as with other styles; little more than a freshwater rinse and lubrication of moving parts is ever required.

DONNING

Jacket BC's can be donned in a number of ways, allowing divers to get suited up quickly and without the need for help. Stronger people can simply pick up the jacket and put it on by slipping their arms through the arm holes the same way as they would when putting on a windbreaker. For others, an easier method is to stand the tank up, inflate the jacket until the arm holes begin to take shape, and then sit down and slip into it. Jacket systems can also be donned in the more controversial, in-water method, but if you prefer to use a crotch strap, in-water donning can be difficult because the strap can be hard to find and adjust in the water.

IN THE WATER

It is in the water, both on the surface and when submerged, that the design features of the jacket style BC's truly stand out. Because lift is provided on all sides of the diver, the jacket style enables you to float in a head up, vertical position on the surface. When the unit is inflated, the reserve buoyancy securely lifts the diver's head high out of the water. The benefits of a high-riding, vertical position cannot be overestimated. Communicating with your buddy is made easy, as is sighting a nearby boat or shoreline, and using a snorkel becomes optional even in slightly choppy water. While a vertical attitude on the surface can be achieved with other styles of BC's, there is no question that maintaining that position is much easier when using a jacket style compensator. It is, at the same time, very easy to lean back

into a comfortable back swimming posture or to roll forward and swim on your stomach. When swimming on your back, the cushion of air behind your head supports it, while the shoulder lift keeps your head comparatively high out of the water so that accidentally inhaling seawater is less likely. Deflation is possible from any position, although slight alterations in technique might need to be made depending upon where the deflator attaches to the bladder.

Underwater, the jacket helps you maintain an optimum horizontal swimming attitude by providing a high center of buoyancy. When swimming face-down, the air in the jacket tends to gather at the top of the BC behind and above the diver's head and back. In that position, the air helps support the weight of the tank much like the lift provided by back BC's. But, when the diver wishes to achieve a vertical attitude on the bottom, any air in the jacket tends to move to the top of the shoulders with the excess evenly distributed in front of and behind the diver. This even distribution allows you to maintain a vertical position, a position that can be hard to hold if all of your buoyancy is on one side of your body. The unique design also enables you to hold still in a head down, feet up posture needed to look into crevices or when trying to sneak up on game.

The inflator/deflator hoses on jackets are easy to find because they are attached in ways that cause them to naturally drape down in front of you, and all the models tested come equipped with Velcro hose attachments. There is some built-in security and safety in a system that allows a diver to look down and see his inflator hose. Jacket units as a rule provide more lift than other styles which makes bringing up a bag of game much easier.

POSSIBLE DISADVANTAGES


While jacket style BC's do in many respects combine the best of the horsecollar and back units, they are not without characteristics that some feel to be disadvantageous. Some divers, especially those with stocky builds, claim that their breathing is restricted when the jackets are inflated. The compensators, they claim, reach a maximum outer diameter and then begin to compress their sides when further inflated. Adjustable straps between the front and back of the jacket help to alleviate that problem. The added lift of front buoyancy means that some bulk is again present in front of the diver. The front panels are not, however, located directly in front of the diver's chest so breathing is not restricted, but moving the front panels from the chest does restrict arm movement to some degree. Once deflated the restriction disappears, so that underwater the front of the jacket is hardly noticeable. For some divers a crotch strap is needed to prevent the system from riding too high and many

find that uncomfortable. As with back BC's, in-water adjustment of the waist strap is routinely required on some models — an inconvenience, but only a minor one, say those who prefer the jacket style. And too, some people find jackets more difficult to remove than other compensators, especially when the unit is inflated (because of the diameter of the arm holes and the lack of flexibility of both the jacket and arms inside a restrictive wetsuit). This feature is merely an inconvenience on the surface, but critics point out it could be disastrous underwater if the unit needed to be ditched. Snorkeling after a scuba dive requires that the tank be removed from the system.

WRAPAROUND

Included in this review is one compensator, Seaquest's Delta, which does not really fit the description of either a back BC or a jacket — it is usually referred to as a wraparound. While it is back-mounted unit that will fit any standard pack, the buoyancy bag is shaped quite differently. When properly mounted, the inflated bag looks like a back BC with arm rests. Behind the diver the unit appears to be just the same as all back BC's, but in addition to back buoyancy, the bag comes around the diver's side giving added lift and stability. The system is comfortable, supports a diver in a near vertical position on the surface, and is very easy to use when swimming on your stomach. It is not, however, designed for swimming on your back, as swimming in this manner will tend to cause your head to dip under the surface due to the high elevation of your hips. This unit will not always float an unconscious diver in a faceup attitude.

CONCLUSION

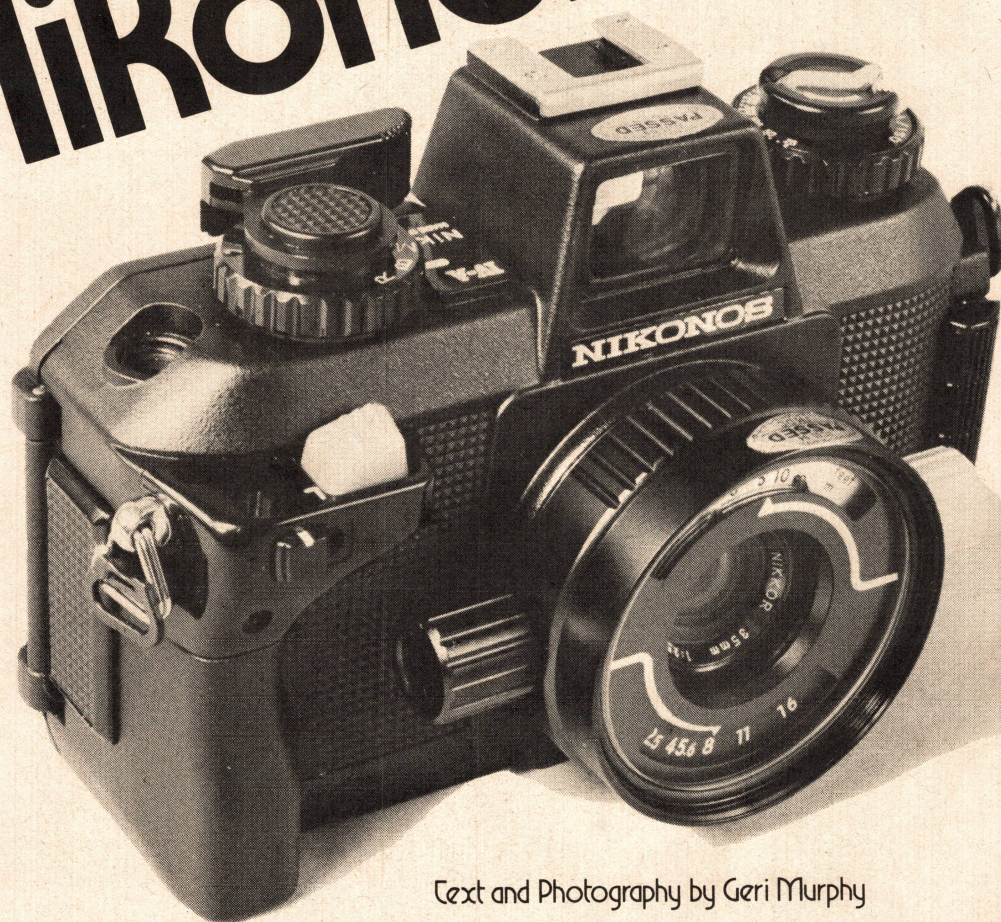
The acceptance of BC's as a standard piece of dive equipment has unquestionably been a great step forward for the dive world. No matter what the style, BC's have made our sport safer, easier and more fun. 

CO₂ CARTRIDGES

CO₂ cartridges come in a variety of sizes, the most common of which are 12, 16, 25, 26, and 38 grams. The size is imprinted on the side of the cartridge. Most can be screwed into any detonating mechanism. The lift capabilities of several sizes of CO₂ cartridges at the surface, at 66 feet, and at 132 feet are listed in the following chart.

Cartridge size	Lift capabilities in pounds at		
	Surface	66 feet	132 feet
12 grams	15	5	3
16 grams	20	7	4
25 grams	32	11	6
38 grams	47	16	9

First Look at the **Nikonos IV-A**



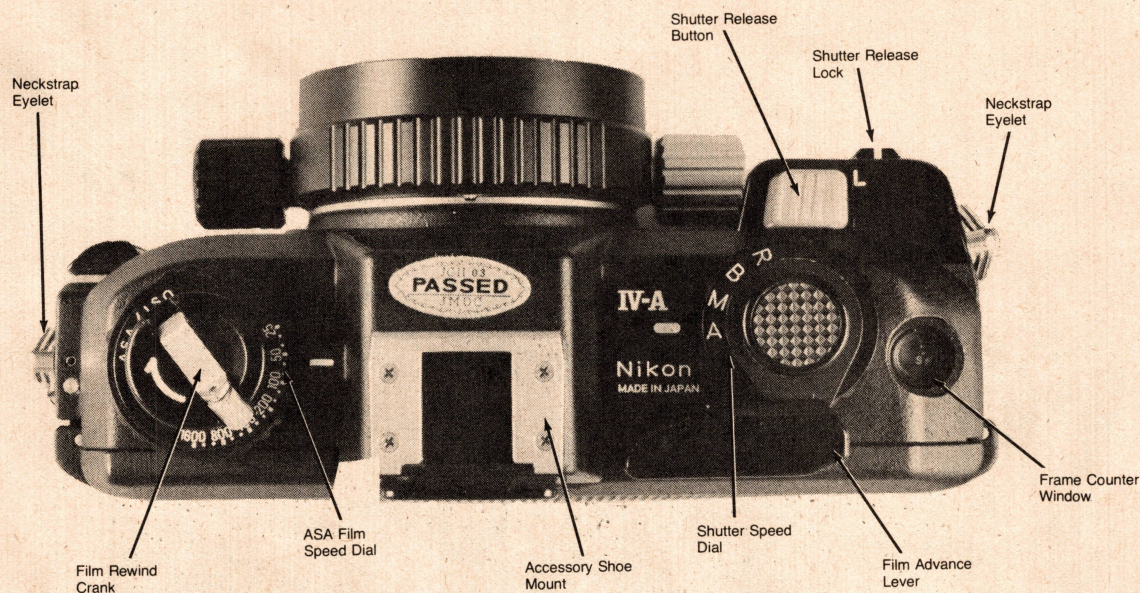
Text and Photography by Geri Murphy

Nikon of Japan has recently introduced its latest, and by far its most extraordinary, model of the Nikonos amphibious camera. Designated the Nikonos IV-A, this somewhat surprising development has caused a shock wave which is rippling throughout the sport diving world. It is the fourth major redesign in the 18 year evolution of the Nikonos concept. The letter "A" indicates it is the first automatic exposure model.

At first glance, the Nikonos IV-A is indeed impressive. It looks significantly different from all previous Nikonos cameras and it has the feel of quality. Just about everything on it is new in design and construction. The camera body is larger and heavier. There are a number of obvious changes which are bound to provoke questions. Will old lenses fit the new camera body? How will the new camera mate up with accessories de-

signed for previous models? Will the underwater strobes currently being manufactured fit this new design?

While SKIN DIVER has not yet had an opportunity to fully test the Nikonos IV-A underwater, we wanted to give the reader a first look at this camera's features. The following rundown will give you some idea of what is different and what has remained the same on this new version of an old favorite . . .



TOP VIEW

CAMERA BODY CONSTRUCTION:

Body is a one-piece design unlike the two-piece design of previous Nikonos models. Constructed of die-cast aluminum alloy and reinforced plastic; O-ring dynamic seals; large molded gasket on the rear door.

CAMERA BODY DIMENSIONS: Body is the same height (99mm) as Nikonos III, but wider (149mm) than Nikonos III (135mm). Body depth (thickness) is also greater (58mm) than previous model (47mm). New, thicker body will not fit accessory flash trays or mounts designed for Nikonos III camera bodies. Accessory manufacturers will no doubt introduce new flash trays to fit this body design.

BODY WEIGHT: 740 grams (1 lb. 6 oz.) as compared with Nikonos III body weight of 620 grams (1 lb. 3 oz.).

LENS MOUNT: Identical to lens mount found on the Nikonos III. The Nikonos IV-A will accept all Nikonos lenses including: 80mm, 35mm, 28mm and 15mm. It will also accept the Seacor 21mm and the Sea & Sea 20mm as well as all macro extension tubes designed for Nikonos III.

FILM FORMAT: Accepts standard 35mm cartridge rolls of either 20 or 36 exposure length. Picture format is 24mm x 36mm — the same as previous Nikonos

models.

FILM ACCESS: Film is loaded and unloaded through a hinged door on the rear of the camera. There is no need to remove lens or disassemble camera body as with previous Nikonos models. Rear door is sealed with a special molded O-ring style gasket and locked by a large cam action latch.

FILM ADVANCE LEVER: Film advance lever swings from the rear of the camera rather than from the front as in previous Nikonos models. Operated by the thumb rather than index finger, it is similar in design to the Nikon land cameras. The advance lever has a 144 degree angle of throw, allowing a full frame advance in one continuous stroke. The lever incorporates a ratchet mechanism which allows a series of shorter strokes if preferred. This lever accomplishes two separate functions — advancing the film, and cocking the shutter simultaneously.

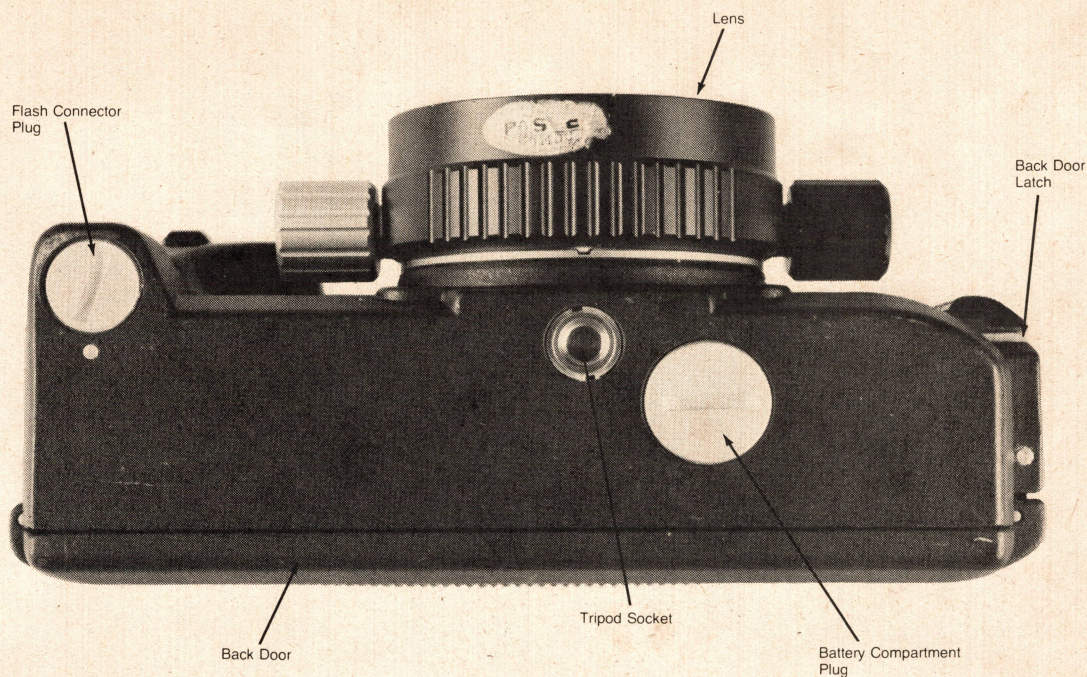
SHUTTER RELEASE: Nikonos IV-A has a separate shutter release button on the front of the camera, just below the film advance lever. This is operated by the index finger and activated by gently depressing the button in a downward direction. Previously designed accessory thumb releases for the Nikonos II and III will not work with this new release and it is

equipped with a safety lock indicated by the large letter "L."

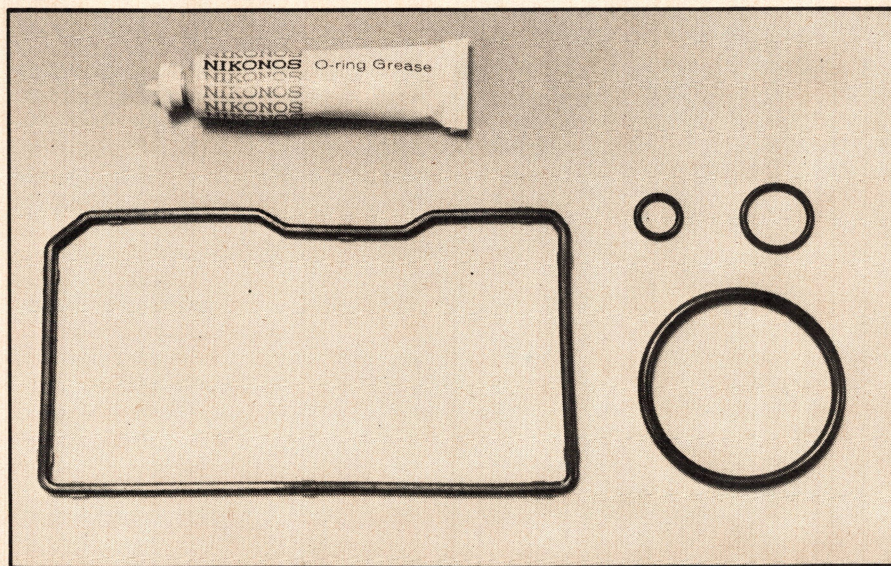
FRAME COUNTER: Frame counter window has been repositioned to the far right of film advance lever. Window is of smaller diameter than that of the Nikonos III, with a smaller frame counter scale inside. The frame counter scale begins with the letter "S," for start. The first numeral on the scale is "1," instead of zero. Subsequent numbers are all even, such as 2, 4, 6, etc. Odd numbers are indicated by a small dot located between the numbers. The camera's automatic exposure system does not begin operating until the frame counter reaches "1."

FILM REWIND CRANK: Similar in design to that of the Nikonos III, but a little more rugged in construction. Conclusion of the rewind function is determined by tension only, as the Nikonos IV-A does not have a rewind indicator dot located in the frame counter window, as with the previous model.

VIEWFINDER: Viewfinder has been repositioned at the top center of the camera, directly above the lens, to eliminate side parallax problems. The viewfinder window has approximately three times larger an area than previous Nikonos'. It is rectangular in shape (instead of circular) and of the same proportions as the film format. The Nikonos IV-A



BOTTOM VIEW



Above, the rear door of the Nikonos IV-A is sealed with a special molded O-ring style gasket.

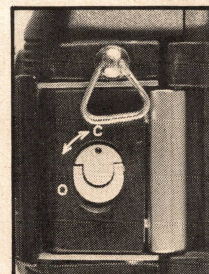
viewfinder has a prism mirror which indicates the LED readouts of the camera's automatic exposure system, thus indicating whether or not there is sufficient light for proper exposure. The viewfinder coverage is compatible with the normal 35mm lens only. Built-in frame lines indicate the area of coverage as well as

parallax correction for close focusing. Optical viewfinder accessories are required for full viewing coverage of other lenses such as the Nikonos 28mm, and 15mm lenses. The same is true for the Seacor 21mm and Sea & Sea 20mm lenses.

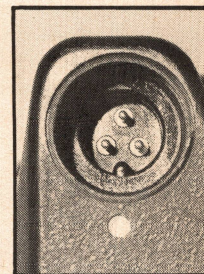
ACCESSORY SHOE MOUNT: Posi-



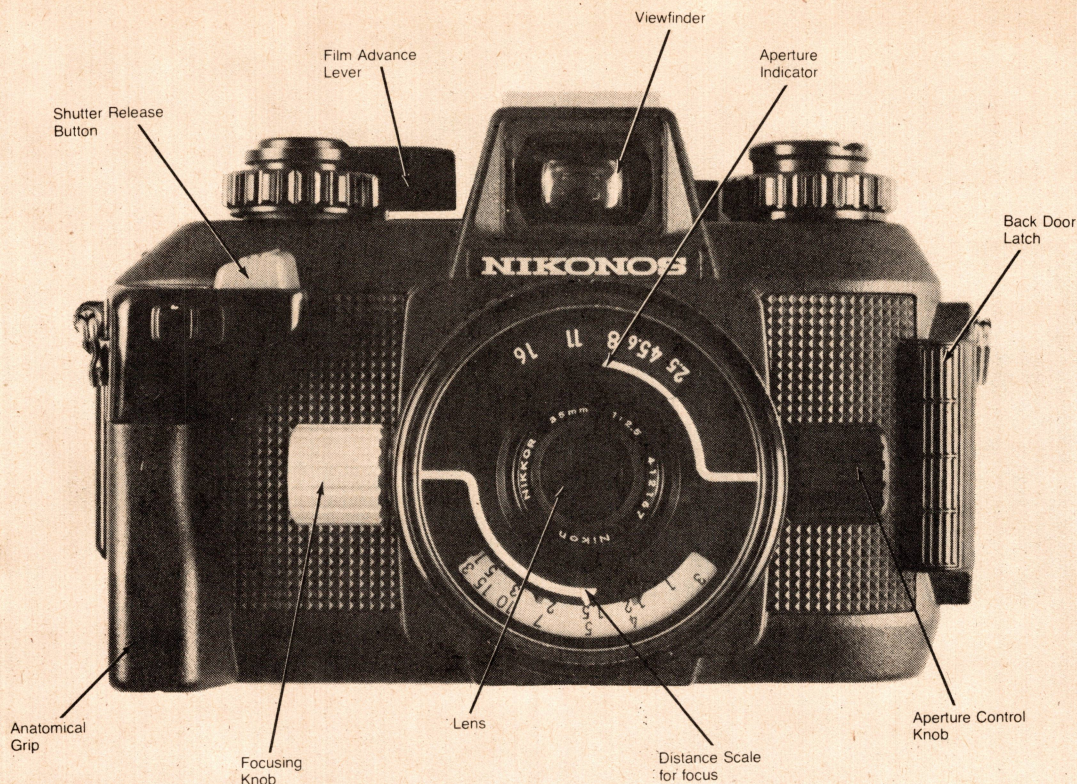
A metering reflector in front of the focal plane shutter allows the built-in light meter to read light passing through the lens and striking the shutter.



The innovative back door latch on the Nikonos IV-A has an open/close locking key.



The Nikonos IV-A flash connector is the standard 3-pin plug used in the previous model.



FRONT VIEW

tioned directly on top of the viewfinder as with other Nikonos models, the new shoe mount is much more rugged in construction, with a reinforcement bar on the front of the shoe. It is mounted onto the camera with four anchor screws — there were three such screws on previous models. The shoe mount is exactly the same size as previous models and will accept all previously designed optical viewfinders, mechanical viewfinders, and other accessories.

FLASH CONNECTOR: Nikonos IV-A has the identical three pin flash socket used in the Nikonos III camera. All previously manufactured Nikonos III EO adapters, Nelson adapters, and direct underwater strobe connectors will fit this new model. The Ikelite Nikonos III SST power pack will not fit because of the new camera body configuration.

FLASH SYNCHRONIZATION: Nikonos IV-A body is designed for X-sync only. It will accept any underwater electronic flash (strobe) but cannot be used with a flash bulb device. The third pin in the flash connection is now being utilized for the new Nikonos IV-A Speedlight SB-101 automatic underwater strobe.

SHUTTER SPEED: Shutter speed dial on the Nikonos IV-A has four basic settings: A — (AUTO): For automatic shutter

speed selection from 1/30 to 1/1000 sec. Auto selection is controlled electronically and linked directly to the camera's built-in light meter. M — (MANUAL): For a mechanical speed of 1/90 sec., the established X-sync for underwater strobes. B — (BULB): A mechanical setting for a wide open shutter used in long time exposures. R — (REWIND): Setting used for rewinding the film.

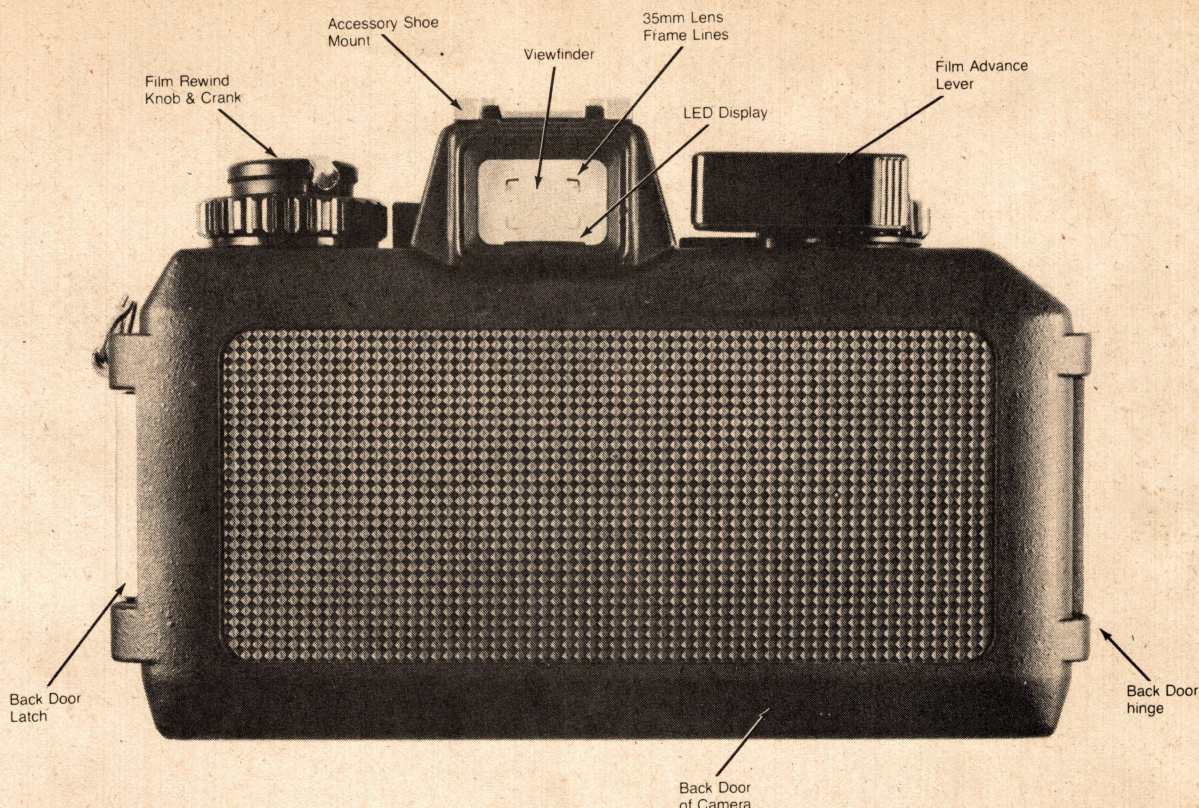
SHUTTER CONSTRUCTION: Metal focal plane shutter is similar to that of the Nikonos III, but a much more advanced design. This shutter was developed to operate with the new electronic circuitry incorporated into the camera. X-sync shutter speed (1/90 sec.) is 50 percent faster than previous Nikonos III models (1/60 sec.). A special set of reflector panels on the front of this shutter permits the camera's built-in light meter to read the light which is actually striking the shutter.

EXPOSURE CONTROL: Nikonos IV-A has aperture priority. An internal silicone cell light sensor measures the light which has passed through the lens and is striking the focal plane shutter. The center-weighted exposure setting measures the overall light of the picture being photographed. Shutter speeds automatically change as you change aper-

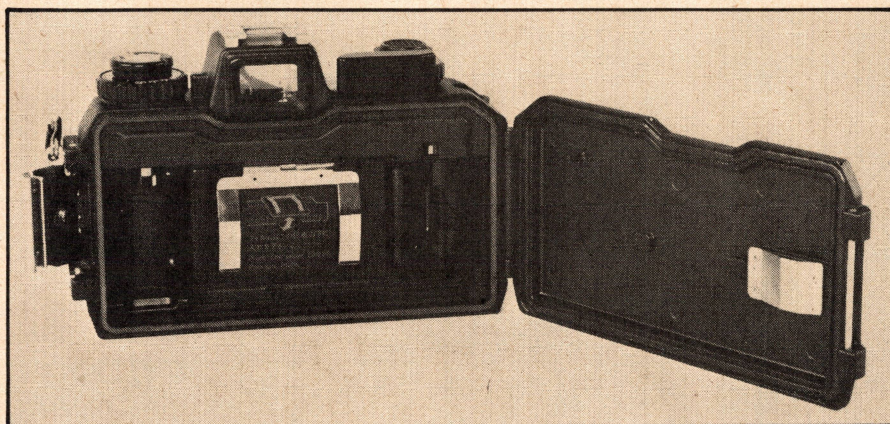
ture settings on the lens.

LED DISPLAY: In addition to selecting the exact shutter speed to be matched with the aperture setting, this camera's circuitry transmits simplified exposure data to the viewfinder via a set of light emitting diodes (LED's). To activate the meter, the shutter release button is depressed halfway. If there is adequate light for exposure at speeds between 1/30 and 1/1000 second, a constant red light will appear in the bottom of the viewfinder. If there is insufficient light for proper exposure, the red light will begin blinking as a warning. When the Nikonos SB-101 automatic strobe is used, a small red lightning bolt will appear in the viewfinder which acts as a ready light when the strobe has recycled. The LED system will shut itself off after 20 seconds of display to conserve battery energy.

BATTERY POWER: The Nikonos IV-A's automatic exposure, LED displays and automatic shutter speed selection are powered by two 1.5 volt silver-oxide batteries. The LED display inside the viewfinder will light up if the batteries have been loaded properly. Their combined voltage is anywhere between 2.6 volts to 3 volts. The batteries are loaded into a cavity in the base of the camera and sealed with an O-ring fitted alumi-



REAR VIEW



num plug. Battery size to be used is Ever-ready EPX76, D76 or equivalent.

FILM SPEED RANGE: A dial just below the rewind crank enables the selection of film speeds ranging from ASA 25 to ASA 1600 for automatic exposure control. The film speed selector can also be utilized as a manual override for the automatic exposure system. By dialing a film speed lower or higher than the film being used, you can overexpose or underexpose your pictures as much as desired.

TRIPOD SOCKET: A stainless steel

quarter-twenty threaded tripod socket similar to those on Nikonos III models has been installed in the camera's base. However, this threaded socket is now closer to the front edge of the camera, directly beneath the lens mount. This socket is designed for attachment of the bracket for supporting the Nikonos underwater Speedlight SB-101.

ULTRA WIDE-ANGLE LENS USAGE: Nikonos IV-A automatic exposure system will only work with retro-focus lenses such as the Nikonos 80mm, 35mm and 28mm lenses. The Sea & Sea 20mm lens

is also acceptable. The camera will not work properly on automatic with ultra wide-angle lenses such as the Nikonos 15mm and the Seacor 21mm. The rear elements of these two lenses project so far into the camera body that they block the light reflected from the focal plane shutter and prevent it from reaching the built-in light sensor. Such lenses can only be used on the mechanical shutter speed setting of 1/90 second.

Judging from the appearance and listed specifications, the Nikonos IV-A is far more than just a slightly improved version of the good ole' Nikonos. It is in fact a total departure in design concept and more closely resembles a submersible version of the Nikon F series of land cameras. This new model could very well be a significant milestone in the Nikonos evolution as it brings the futuristic technology of automated electronics to the underwater world of photography. A future issue of SKIN DIVER will carry a test report on its performance.

There is one more piece of exciting news and that is price. The Nikonos IV-A retails for \$399 (body only), only an 11.5 percent increase over the previous model. New Nikonos buyers will be getting a whole lot more camera for their money.

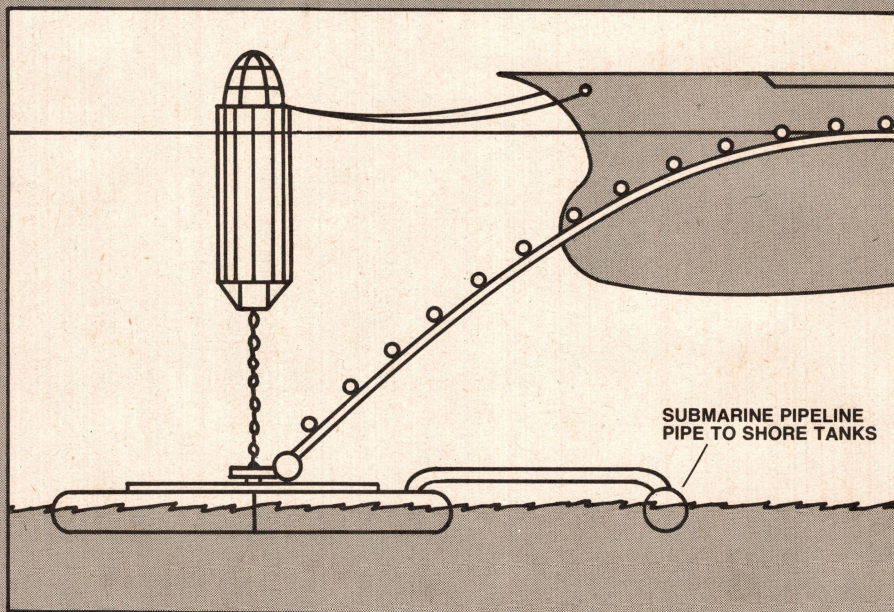
Technifacts

BY E.R. CROSS



In the last Technifacts various aspects of marine hose inspections were discussed and the importance of a marine mooring system and its ancillary equipment was mentioned briefly. I also stated that the most frequent job a commercial diver is called on to perform is one of inspection. The consensus of owner-operators of offshore terminals is that inspections and preventive maintenance are a sound investment and most of them retain divers for these purposes. The large number and various types of systems provide a potential source of employment for commercial divers in all parts of the world; either as employees or as contractors.

In this month's Technifacts we will discuss offshore moorings. An offshore mooring may be for discharging or receiving any type of cargo and will usually consist of a single buoy or a number of smaller buoys to hold the vessel in a more or less fixed position, and a method of discharging the cargo to an onshore terminal. Underwater pipeline systems are usually used to transport the various types of bulk cargo, but particularly bulk liquid cargoes such as oil and other hydrocarbon products.



Above, the single anchor leg mooring (SALM) for shallow water has a large base structure with a chain riser. In this unit, the float-sink hoses come off a hose arm at the base. Right, multiple buoy moorings (MBM) may use three to eight mooring buoys to hold the vessel in position while discharging or receiving cargo.

TYPES OF OFFSHORE MOORINGS

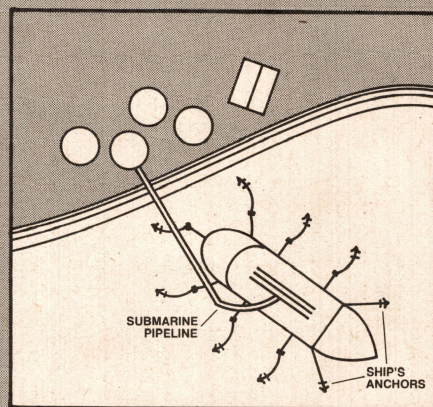
Many sizes and types of offshore deepwater oil terminals are successfully operated in many areas of the world. Numerous designs have been developed in an effort to cope with the myriad of variations in the distance from shore of the structures, depth of water, bottom conditions, effect of wind, waves and ocean swells, current and the kinds and volumes of products to be handled by the terminal.

At present, offshore terminals can be classified rather broadly as: multiple buoy mooring (MBM), single buoy mooring (SBM), (also called single point mooring (SPM)), and fixed tower mooring (FTM). There are many variations of these basic types.

Regardless of the type of mooring, the inspector-diver must have detailed knowledge of the environmental and physical conditions of the mooring and mooring site. He must know the operating characteristics and limitations of each type of terminal and he must use sound judgment in making his reports and recommendations to the operator of the terminal.

MULTIPLE BUOY MOORING (MBM)

Multiple buoy moorings may use three, five, six, seven, or eight mooring buoys to hold the vessel in position. In most, but not all, systems using multiple buoys, the vessel's anchors are used to help hold it in position while discharging or receiving cargo. The design of the mooring will usually be such that the vessel will be held with its bow into the prevailing wind and current. Each buoy will be fitted with a chain and anchor of appropriate size and weight to hold the vessel on station in the mooring.



SINGLE POINT MOORING (SPM)

Single point moorings are primarily used in the petroleum industry to moor the very large crude carriers (VLCC's). Two types of SPM's are: single buoy moorings (SBM's), and single tower moorings (STM's). Two additional moorings have recently come into being, both of which are classed as SPM's. One of these is called an articulated loading column (ALC), the other is known as an exposed location single buoy mooring (ELSBM). All of these units are very large — the ELSBM weighs up to 3000 tons.

The most common SBM is the catenary anchor-leg mooring (CALM). Essentially, a CALM is composed of a large buoy held in place by multiple anchors and chains, to which the tanker is attached by a mooring line at the bow. A hose system rises from the pipeline on the ocean floor to the buoy and, via floating, or float-sink, hoses to the tanker. Since the anchor system prevents the buoy from turning, the CALM buoy uses a rotating turntable to carry the hose manifold in its circle following the tanker's turning with wind and tide.

Another type of SBM is the single anchor leg mooring (SALM). There are two models of SALM; both have large base

(Continued on Page 90)

SDM travel

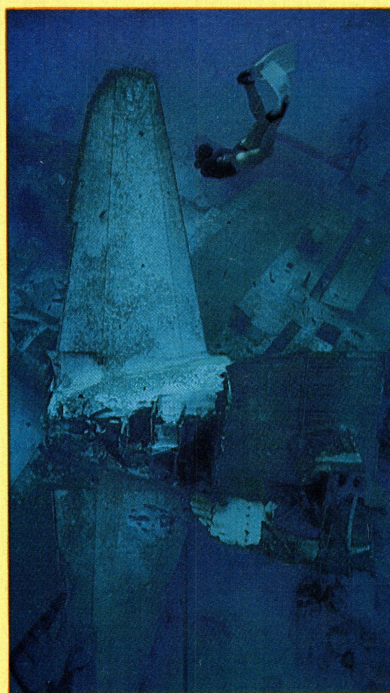
SECTION

COZUMEL'S UNDERWATER TRAIL

By Dr. George S. Lewbel
Photographs by Bob Evans

Within a five minute swim from a step-in entry at La Ceiba Beach Hotel's pier lies a beautiful area of coral patch reefs in the warm, clear Caribbean water that bathes Cozumel Island. An underwater educational trail was recently installed to teach skin and scuba divers about reef biology. The trail consists of 15 permanently numbered stations along a circular route beginning and ending at the pier, and following a ridge covered with corals, sponges, and gorgonians. Each station marker has been placed on the bottom at a spot chosen for its biological and/or photographic interest. The area has been designated a preserve from which nothing living may be collected.

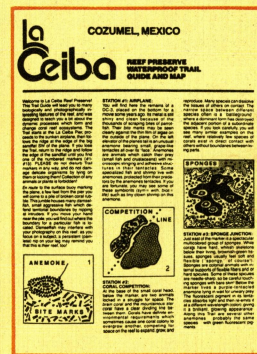
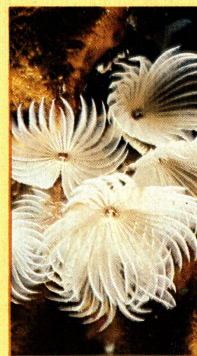
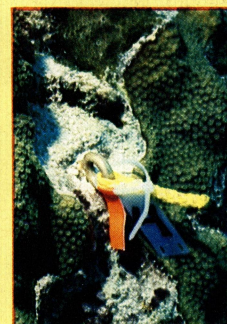
Divers following the La Ceiba Reef Preserve trail may borrow (gratis) one of the waterproof Trail Guides available at the hotel desk. These include a map of the trail showing locations of all stations and a short description of each. Station depths range from 9-35 feet (3-11 meters). The trail takes about 30-45 minutes to swim, including a stop at each station. Bronze eye bolts with numbered tags have been installed at each station by drilling a small hole in the top or side of an appropriate surface (always avoiding living coral), filling the hole with a quick-setting underwater epoxy cement, then inserting a bolt. The bolts are relatively unobtrusive, and were positioned to be visible from above so that skin divers could pick them out. The bolts were placed about three feet away from each feature described in the Trail Guide, so that when divers settle down on the bottom next to the bolts they will not damage adjacent reef animals.



The stations on the trail were selected to teach divers about some of the dynamic processes affecting coral reef ecosystems, as well as to help divers identify many of the more common animals. Divers completing the route will probably learn many things they didn't know about energy flow, competition, predation, and community structure within coral reefs. Simple, clear descriptions of each site have purposely omitted scientific names and details of animal classification in order to make the Trail Guide useful to divers with no biological training.

Several station descriptions from the Trail Guide are shown here as samples:

STATION #1: AIRPLANE— You will find here the remains of a DC-3, placed on the bottom for a movie some years ago. Its metal is still shiny and clean because of the thousands of scraping bites of parrotfish. Their *bite marks* may be seen clearly against the thin film of algae on the outside of the plane. On the



left elevator of the plane's tail is an unusual *anemone* bearing small, grape-like tentacles all over its face. Anemones are animals which catch their prey (small fish and crustaceans) with microscopic stinging and adhesive structures in their tentacles. Some specialized fish and shrimp live within anemones, protected from their predators by the anemones' tentacles. If you are fortunate, you may see some of these *symbionts* (sym = with, bios = life) such as tiny clown shrimp on this anemone.

STATION #2: CORAL COMPETITION—

At the base of the small coral head, below the marker, are two animals locked in a struggle for space. The *brain coral* and the *mountainous star coral* have a clear dividing line between them. Corals have definite environmental requirements which sometimes cause one coral colony to overgrow another, competing for space on the reef to ex-

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COZUMEL TRAIL

pand, grow and reproduce. The narrow space between different species is often a battleground where a dominant form has destroyed the adjacent portion of a subordinate species. If you look carefully, you will see many similar examples on this reef, where relatively few species of corals exist in direct contact with others without boundaries between living parts.

A lobby display of photographs taken on and near the trail will be of interest to divers and non-divers alike. Most of the photographs depict animals along the trail, and encourage divers to learn more about what they see in the preserve. For those curious about the techniques used in installing the trail markers, several photographs illustrate the process. In addition, the hotel provides, at no charge, frequent slide shows for visitors. These slide shows mainly include subjects from the trail.

The basic idea behind the trail is that an informed diver is more likely to be a conservation minded diver. Much of the damage we are starting to see in well-traveled coral reefs results from ignorance about the effect of our sport on delicate organisms. Significant reef deterioration has occurred in areas where divers anchor boats carelessly, break and collect coral, flip rocks, and otherwise enjoy themselves without regard for the substantial amount of time a reef may require to recover. The Trail Guide stresses appreciation for the complexity and fragility of coral reefs, and emphasizes that other areas outside the boundaries of the preserve need the same consideration that officially designated look-but-don't-touch sites are given.

The trail and its underwater Trail Guide were conceived and assembled by Dr. George S. Lewbel, a marine biologist with LGL Ecological Research Associates of Bryan, Texas; and by Bob Evans, a photographer with La Mer Bleu Productions of Santa Barbara, California.

TROPICAL ADVENTURES

Bob Goddess, dive tour organizer, has scheduled three tropical dive adventures. Over Christmas there is a trip to Ambergris Cay with dives at the famous Blue Hole and Lighthouse Reef, followed by a few days at the fantastic Mayan ruins of Tikal and New Year's Eve in New Orleans. In November, 1981, Bob returns once again to the Fiji Islands, diving enchanted Mana and the garden island, Taveuni. Those interested may contact Bob Goddess, 1425-4th Ave., #624, Seattle, WA 98101.

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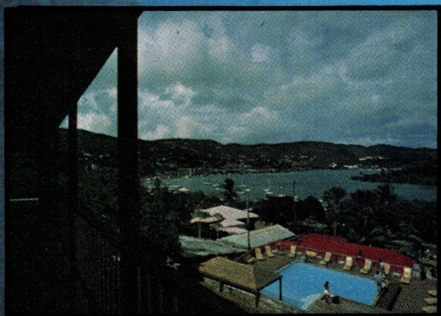
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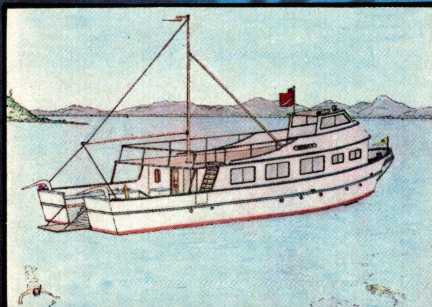
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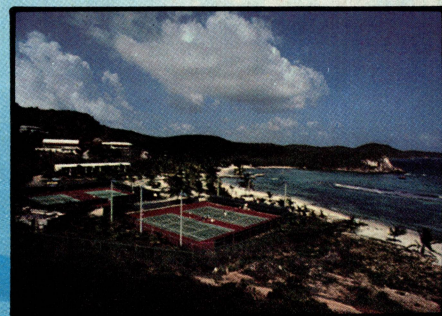
The good word here at the St. Thomas Diving Club is professional. We look, act and are professionals. Our head instructor is the world renowned photo journalist, adventurer and T.V. personality, Armando Jenik. He is surrounded by the Caribbean's largest team of professional instructors. Our diving equipment is the best & safest money can buy.

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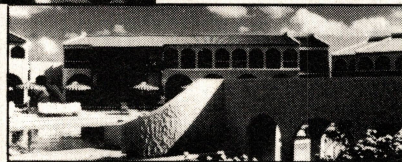
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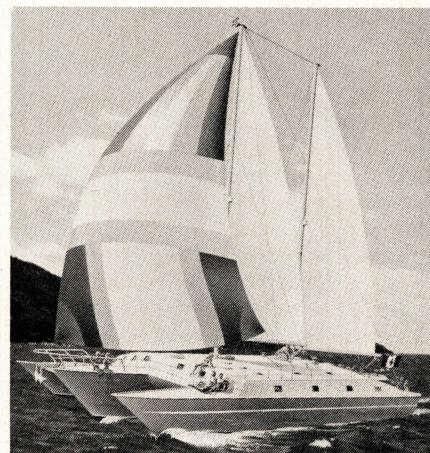
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Trimarine Boat Co. has a new sail/dive boat, the *Lammer Law*, which starts service in the Virgin Islands this month. The *Lammer Law* is the largest trimaran in the world, an aluminum beauty, 95 feet long and 42 feet wide. She has twin Caterpillar V8 diesels and over 5000 square feet of sail, schooner rigged with masts towering 90 feet above the sea; three



tenders, two with 60 hp motors, two compressors, electrical generating capacity of 80kw. Each two-person stateroom, with private bathrooms, exceeds 125 square feet. Each is available in either twin or double configuration. The main salon is 25 feet long and 22 feet wide, furnished with easy chairs and sofas and equipped with projection facilities, hi-fi and a bar. There is a crew of six with two dive instructors.

As with Trimarine's *Misty Law*, the price includes everything — even the drinks and wine are free. Eight, 11 and 15 day tours are offered and group rates are available. The tours qualify for the low IT fare which if used, particularly midweek, can save up to 30 percent of the air fare. Contact: Trimarine Boat Co., St. Thomas, U.S.V.I. 00801.

CAYMAN KAI EXPANDS

Cayman Kai Resort, Grand Cayman, has a second 28 x 14 foot flattop dive craft which easily accommodates 16 divers. This type boat has gained acceptance with operators throughout the Caribbean owing to its large deck area and stability. This brings the number of boats operated by the resort to five, including three 22 foot Aquasports used mainly for fishing, skiing, snorkeling, etc. Located on the cool northside, Cayman Kai is the only resort to dive the famous North Wall every day. Most dive sites can be reached in 20 minutes.

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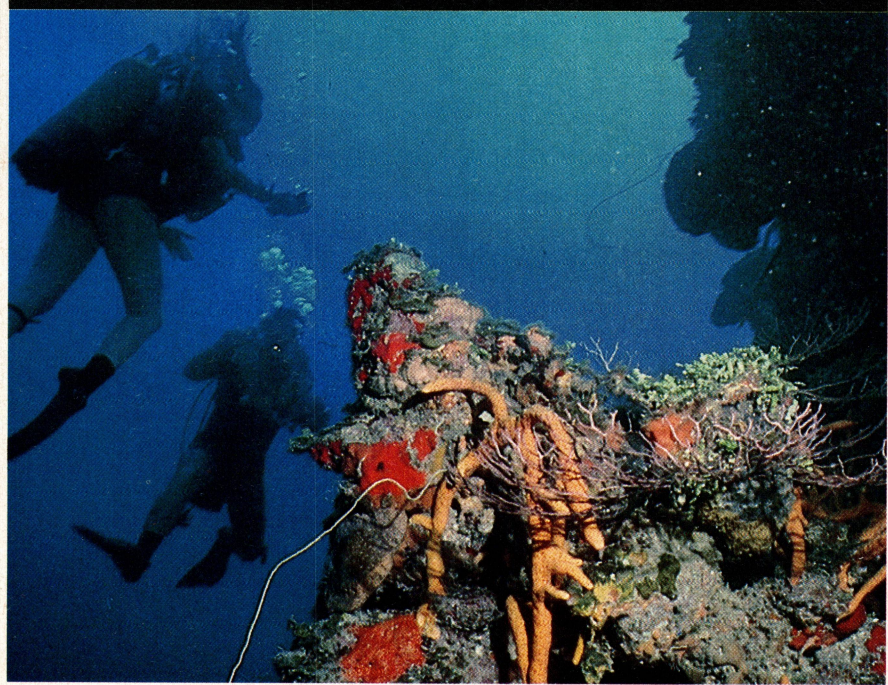
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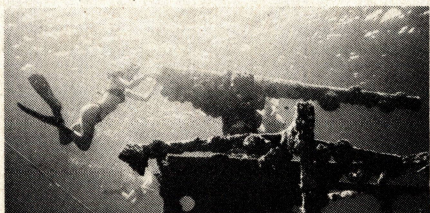
Additionally, all units have kitchen facilities for those people wishing to prepare their own meals. For information contact Hotel Plans, 1200 Harger Road, Oak Brook, IL 60521. 🐟

GALAPAGO INN, COZUMEL

A new attraction has been added to the Galapago Inn Resort, Cozumel. The sunken 57 foot shrimp boat *No Shipw* was salvaged from the drop-off by the staff of Scuba Cozumel Dive Shop and moved about 50 yards from the hotel beach. The wreck is now in 20 feet of water. Marta and Pedro Delgadillo, owners and operators of this PADI training facility, are pleased to offer their newly acquired wreck to all guests of the Inn, which has become the divers' residence of the Mexican Caribbean.

MICRONESIAN SAFARIS '81

Sea Safaris begins its 1981 season with a January 16 departure date for Micronesia. The tour group will dive in both Truk and Palau with an optional extension available for Ponape. Sea Safaris will arrange group, individual and custom dive travel to these other destinations: Tahiti,



the Cayman Islands, the Bahamas, Cozumel, Roatan, the Red Sea and the Maldives. For information contact: Sea Safaris, 3701 Highland Ave., Suite 304, Manhattan Beach, CA 90266. 🐟

SCUBA DIVING AT PETER ISLAND

Peter Island Hotel and Yacht Harbor in the British Virgin Islands has added a new scuba diving shop to its extensive watersports program. Mike Kilbride, the scuba specialist, supervises the dive shop and offers a three hour PADI resort course to introduce guests at Peter Island to scuba diving.

There are more than 50 dive sites surrounding the secluded Peter Island resort. They range from coral forests to ancient and modern wrecks and include the *Rhone*, site of the underwater filming of Peter Benchley's *The Deep*. One-tank and two-tank dives are available for all levels of divers. The small fee for instruction and underwater tours opens a spectacular world to the visitors of Peter Island.

Peter Island Hotel and Yacht Harbor, with just 32 rooms, is the only resort on the island and provides 545 uncluttered acres to explore on foot or horseback and miles of unoccupied beaches. Reservations may be made through David B. Mitchell & Company, 777 Third Avenue, NY, NY 10017. 🐟

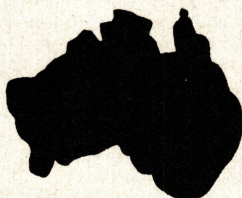
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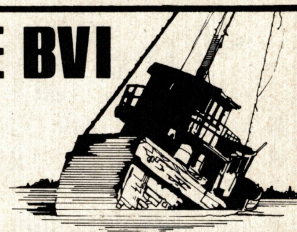
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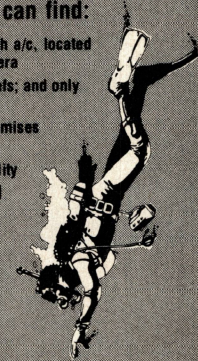
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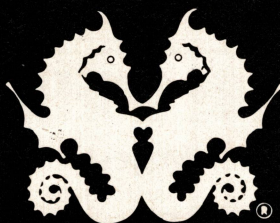


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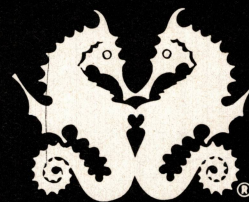


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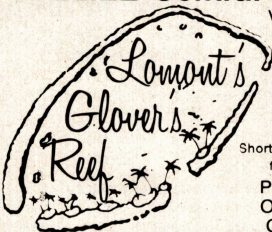
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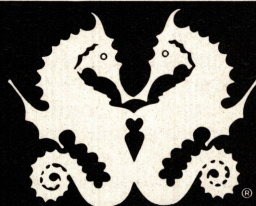
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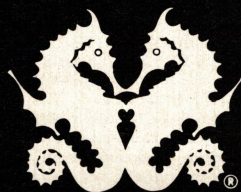
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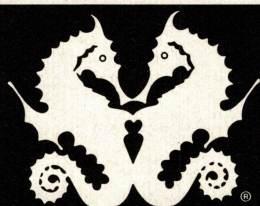
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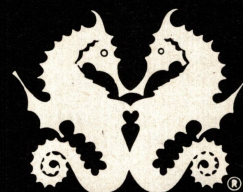
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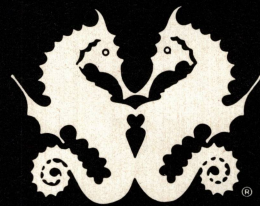
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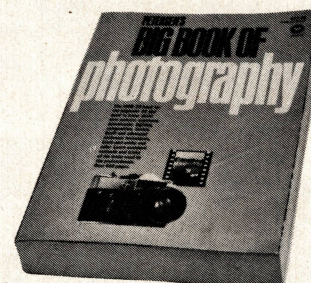
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
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Scuba Quiz

Category: Self Rescue

By Dennis Graver

As a diver you have a number of responsibilities. Among them are the responsibility of preventing problems; the responsibility to your buddy; and the responsibility of taking care of yourself if a difficulty arises. Test your knowledge of self rescue with the following questions. Answers are on the next page.

1. While swimming along the bottom in 40 feet of water you begin to experience air starvation. All of your equipment is working properly. Select the preferred action:

- ☐ A. Make a normal ascent and rest on the surface.
- ☐ B. Stop swimming and rest awhile on the bottom
- ☐ C. Make an emergency swimming ascent
- ☐ D. Stop swimming and breathe rapidly and shallowly

2. While underwater you become extremely nauseated and realize you are going to throw up. You should:

- ☐ A. Hold your regulator tightly in your mouth and vomit through it
- ☐ B. Remove your regulator from your mouth while you are throwing up
- ☐ C. Hold your regulator against your mouth with the purge button depressed
- ☐ D. Pull your mask down over your mouth and throw up into the air space

3. Swallowing can be effective for:

- ☐ A. Overcoming choking
- ☐ B. Extending breath-hold time
- ☐ C. Regulator clearing
- ☐ D. All of the above

4. When in difficulty at the surface while diving, which of the following actions should be taken first:

- ☐ A. Signal for assistance
- ☐ B. Rest and breathe deeply
- ☐ C. Establish buoyancy
- ☐ D. Notify your buddy

5. If a leg cramp occurs while diving, you should:

- ☐ A. Compress and pound the cramped muscle
- ☐ B. Stretch and massage the cramped muscle
- ☐ C. Wait until the muscle relaxes, then proceed
- ☐ D. Exit the water and treat the cramped muscle

6. When you surface from a dive, your boat is nowhere in sight. The nearest land is miles away and there is a slight current. You should:

- ☐ A. Swim slowly against the current to maintain position and generate body heat
- ☐ B. Get buoyant, drift with the current, and keep activity to a minimum
- ☐ C. Swim slowly and steadily in the direction of the nearest shipping lane
- ☐ D. Get buoyant and swim steadily toward the nearest land

7. In which of the following situations should a diver's weights be jettisoned?

- ☐ A. Air supply depletion at a depth of 30 feet
- ☐ B. A buddy breathing ascent from 50 feet
- ☐ C. An emergency swimming ascent from 75 feet
- ☐ D. All of the above

8. When sudden and severe vertigo occurs underwater, which of the following actions will be the most helpful in overcoming the effects?

- ☐ A. Hugging yourself
- ☐ B. Holding onto a stationary object
- ☐ C. Performing a valsava maneuver
- ☐ D. Swimming to the surface

9. While underwater you find yourself alone and entangled. Your initial reaction should be to:

- ☐ A. Remain still and wait for assistance
- ☐ B. Stop, study, and analyze the problem
- ☐ C. Determine the point of entanglement and cut yourself free
- ☐ D. Make one all-out attempt to break free

10. Halfway through a dive you surface and find yourself well down current from your charter boat. You should:

- ☐ A. Get buoyant and signal for assistance
- ☐ B. Use remaining air to navigate back to the boat along the bottom
- ☐ C. Swim toward the boat on the surface as long as possible, then submerge and continue using scuba
- ☐ D. Tack back and forth across the current at the surface until you reach the boat

Scuba Quiz

Answers: Self Rescue

1. B. Stop swimming and rest awhile on the bottom. Breathing resistance, dead air space, and partial pressures all combine to create a feeling of suffocation if exertion is excessive. Avoid over-exertion, breathe deeply, and reduce activity at the first symptom of air starvation.

2. C. Hold your regulator against your mouth with the purge button depressed. Vomitus can clog a regulator second stage, but gasping can be disastrous with the regulator removed from the mouth. Don't dive if nauseated, but if you are suddenly overwhelmed, remove the regulator, hold it at one corner of the mouth, and keep the purge depressed while vomiting.

3. D. All of the above. A drop of water on the glottis causes choking. Swallowing can help arrest the spasms. The swallowing reflex can override the urge to breathe. And, if all else fails, the water can be sucked out of a regulator and swallowed in order to clear the mouthpiece.

4. C. Establish buoyancy. Nothing is more important than making certain that you will remain at the surface. A number of actions can be taken once a diver is buoyant, but if some other action is taken first, the diver could become exhausted or panic and be unable to take other action.

5. B. Stretch and massage the cramped muscle. A cramp is a strong, involuntary contraction of a muscle. It is important to get the muscle stretched out and to restore circulation in order to prevent tissue damage. A twitch in a muscle may signal an imminent cramp. Changing swimming strokes can help prevent cramping by use of different sets of muscles.

6. B. Get buoyant, drift with the current, and keep activity to a minimum. Save all of the energy possible. Your greatest threat is overexposure — loss of body heat. A fetal position will help reduce loss of heat. Even if you shiver, avoid exercise. If you filed a float plan, as is recommended, someone will find you within hours.

7. C. An emergency swimming ascent from 75 feet. The various diver training agencies are in agreement that a buoyant ascent is appropriate when it is doubtful that the surface can be reached by swimming. When the weights are ditched, an ascent is no longer controlled. In fact, there are some situations where a diver is worse off if the weights are ditched. If you can swim up, do it. If not, jettison the weights.

8. B. Holding onto a stationary object. Loss of equilibrium sets the world spinning about you. A reference is somewhat comforting until the vertigo passes. You should stop swimming when dizzy because you can easily proceed in the wrong direction. If there is no object to grasp, answer A is the best alternative.

9. B. Stop, study, and analyze the problem. Don't turn around or make sudden moves! Most of the time an entanglement involves the scuba tank. Determine where the entanglement is, and if it is above and behind you, slip out of your tank and clear the snag. Be careful if a knife is used.

10. B. Use remaining air to navigate back to the boat along the bottom. The current is least at the bottom. By following a compass heading straight back to the boat, you should be able to reach it or get close enough to grab the current line strung out behind the boat. Trying to swim into a current is unwise and will quickly lead to exhaustion.

A buddy can be a valuable asset if a problem arises, but if you are unable to get his or her attention, you need to be self reliant. Many self rescue techniques can be learned in continuing education dive courses. It is also valuable to discuss problem situations with other divers and to share ideas on how to handle the difficulties that can arise while diving. Don't let experience be your teacher . . . Be prepared and be safe.

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regulator performance

US Navy report interpreted especially for Skin Diver By George Cozens

Although it is only one of several considerations in the selection of a scuba regulator, performance gets a great deal of attention. Obviously, since regulators are critical components in their life support equipment, divers want regulators that perform well.

The term performance can have different meanings to different people: Trouble-free operation, long lifetime of service, overhauls and/or tune-ups required only infrequently, and efficient operation might be a few. Of these various conceptions, the one that does not necessarily depend to a large extent on the diver's own routine maintenance is the last — efficient operation. We could call this engineering performance, since it is a quality designed and built into the regulator from the start. This type of performance has to do with the regulator's ability to supply air to the diver with the least amount of effort under varying conditions of depth (in water), supply (tank) pressure, and amount of air required by the diver. With this definition in mind, a high-performance regulator would be one that delivers a greater amount of air with less effort by the diver than a regulator of lower performance.

As mentioned in the article, Regulator Roundup, SKIN DIVER — June, 1980, several characteristics contribute to a regulator's performance: breaking effort (also called cracking pressure), an indication of how hard the diver must inhale to initiate the airflow; inhalation effort, how much effort must be expended to keep the air coming in the quantity required; flow rate, the amount of air that can be supplied at any one time; and exhalation effort, the effort the diver must exert to exhaust the air into the water. Adding to the complexity of regulator performance evaluation is the fact that these characteristics will change, depending on the conditions of depth, supply pressure, and volume of air moved within a given time (i.e., airflow). Measuring these breathing characteristics accurately to determine performance requires trained personnel, complicated laboratory equipment, and sophisticated techniques; all of which boils down to an expensive testing

operation — beyond a company's means.

Enter the U.S. Navy. Also mentioned in Regulator Roundup, was the fact that the U.S. Navy Experimental Diving Unit (NEDU — to its close friends), located in Panama City, Florida, conducted performance tests on 36 regulators in the summer of 1979. These included all of the scuba regulators that were manufactured in the U.S. at that time. Under the direction of James Middleton, test engineer for NEDU, the evaluations were made under widely varying conditions that could apply to sport as well as Navy diving: Effective depths ranged from 0 (the surface) to 300 feet of salt water; supply pressures varied from 1000 psi (simulating a tank about one-third to one-half full) to 500 psi and 300 psi (tank almost empty); and air consumptions ran from finicky (a small diver under a very light work load — e.g., 15 breaths per minute breathing 1.5 liters of air per breath) to Gargantuan (an oversized gorilla laboring under an extremely heavy work load — e.g., 30 breaths per minute at 3.0 liters per breath — I don't think that even Dolly Parton has this much lung capacity).

To me these tests represent a milestone in the scuba diving industry. Not only were all the regulators tested under an extremely wide range of identical conditions, but regulator manufacturing representatives were present to witness their own products being tested. Such complete evaluations performed on so many regulators must surely be an asset to the diving industry — providing information that is invaluable in redesigning and improving regulator performance in the years to come.

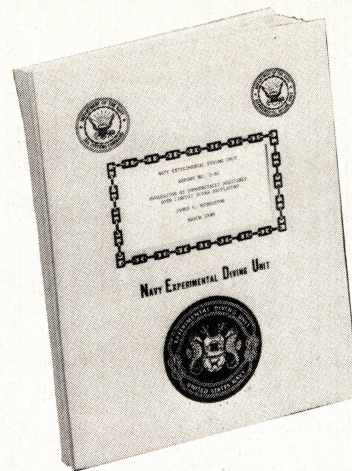
The results of the tests were published by the Department of the Navy as Navy Experimental Diving Unit, Report No. 2-80, entitled, *Evaluation of Commercially Available Open Circuit Scuba Regulators*, by James R. Middleton, dated March, 1980. (As originally planned, some of the test results were to appear in the table of "Regulator Roundup." The text laid the groundwork, but (alas) when the article had to go to print all the results appearing in Report No. 2-80 were still in the great U.S. Postal System, some-

where between Panama City and Los Angeles. My apologies to those of you who searched through the article in vain, looking for data that didn't appear.)

Generally, the results of the regulator evaluation looked very good. As Mr. Middleton stated in the conclusion to his report, "The overall performance of the regulators tested was found to be outstanding . . . This is a significant improvement over regulator performance of only four years ago."

The report can be very interesting to the technically oriented reader, but to many divers the results may be hard to understand because all of the test data appear in the report in the form of graphs with little lines running from dot to dot, box to box, or triangle to triangle, depending on the test parameters being plotted. Of course, all of these graphs are easily comprehended by scientists and engineers, but anyone else would probably find it all a little confusing. In an effort to make interpretation of the results a little easier to understand, I converted the graphs to numbers (work scores if you will) representing the results of two of the performance tests conducted on each regulator. These work scores appear in the accompanying table, and are a relative indication of the breathing work of the regulators — that is, the work a diver would have to exert just to breathe from the regulator (through one inhalation/exhalation cycle) under the test conditions specified. Lower numbers indicate less work must be performed under the test conditions — hence, lower numbers (like golf scores) indicate more efficiency, and, therefore, higher performance in a regulator.

The first column of work scores represents the breathing work under conditions which are more appropriate to sport diving: Effective depth of 132 feet in salt water (just a test parameter, not a recommendation for sport divers to dive this deep); supply pressure of 1000 psi; air consumption of 40.0 liters per minute (as in 20 breaths per minute and 2 liters per breath) — this would correspond to a moderate diver work load. The second column represents breathing work under a heavier work load — approximate to



REGULATOR WORK SCORES 132 feet, 1000 psi tank pressure

Manufacturer/Model	Work Score—Work required to obtain air	
	Moderate Workload*	Heavy Workload**
AGA Divator 324/U.S.D. Conshelf XIV	14	29
Dacor C3NB (2 hose regulator)	30	Not Given
Dacor Pacer 150	22	45
Dacor Pacer 300	21	32
Dacor Pacer 600	21	30
Dacor Pacer 900	20	30
Jepsen Model 200	14	24
Poseidon Cyclon 300	9	14
Scubamaster Model 7687	10	13
Scubapro Mark V (4 port swivel)	13	23
Scubapro Pilot Mark V (4 port swivel)	11	21
Scubapro Mark V (5 port swivel)	15	26
Scubapro AIR 1/Mark V (4 port swivel)	9	14
Scubapro AIR 1/Mark V (5 port swivel)	6	8
Scubapro AIR 2/Mark V (4 port swivel)	29	43
Seapro FSDS-10	20	33
Seapro FSDS-50	21	33
Sherwood Selpac SRB-2000	14	18
Sherwood Selpac SRB-3100	14	18
Sherwood Selpac SRB-4100	15	22
Sportsways WL-200	18	31
Sportsways W-600 Hydronaut	18	31
Sportsways W-900 Waterlung	19	31
Sportsways W-950 Arctic	21	38
Sportsways Model 1390	22	52
Sub Aquatic Systems Sub II	20	33
Sub Aquatic Systems Sub X	15	23
Swimaster R14 Polaris	19	35
Swimaster MR12	16	25
Swimaster MR12-II	15	23
Tekna T-2100	7	16
Tekna T-2100 B	6	11
US Divers Aquarius	13	17
US Divers Calypso VI	13	13
US Divers Conshelf XIV	11	14
White Stag Deep V	16	26

*40 liters of air per minute

**62.5 liters of air per minute

The work scores are a relative indication of the exertion required to breathe from the regulator. Lower numbers indicate less work must be performed — hence, lower numbers equal higher performance.

Navy diving: Effective depth and supply pressure are the same, but the air consumption was increased to 62.5 liters per minute (25 breaths per minute at 2.5 liters per breath). Incidentally, the results appearing in this second column formed the basis for developing an upgraded NEDU performance requirement (for accepting or rejecting scuba regulators used by the U.S. Navy).

In examining these performance results, a few points are worth considering:

1) The performance of most regulators showed little or no decrease when supply pressures were reduced to 500 psi, but performances did decrease significantly for a number of regulators when supply pressures were reduced to 300 psi — an indication to sport divers to avoid staying deep or breathing heavily (e.g., doing

hard work) as the tank pressure gets low.

2) The work scores were derived from measurements made by precision equipment. In practical use, under normal conditions, most divers would not be able to tell any difference in the breathing characteristics of two regulators whose work scores are close in value (within one or two units).

3) Just how much performance you might require in a regulator depends to a large extent on you and your type of diving: If you might get into situations requiring you to breathe heavily (i.e., high air consumption), especially at greater depths, then you would do well to look at the higher performance regulators. Under conditions of less air consumption and shallower depths, the differences in breathing work between high and moderate performance regulators (performance numbers in the mid-range) becomes less apparent — so for most normal dive applications a regulator of moderate performance should function more than adequately. Being less sensitive to slight pressure changes, moderate and lower performance regulators should not cause some of the little annoyances that may be encountered with the easy-breathers: popping, fluttering, and/or freeflowing (when swimming rapidly, or into the current, or when diving upside down). Low performance regulators (those with greater numbers) are not necessarily bad, they are just not recommended for deep diving. If their other qualities recommend them, they may be used to good advantage in a pool or other shallow water diving.

Have fun with these numbers. Use them to compare one regulator against another. If you are interested in a regulator that is not listed, try to compare it to one that is listed by using both on pool or open water dives — then you can make your own performance evaluation.

TECHNICAL NOTE

As mentioned earlier, the work scores listed in the table are relative indications of the breathing work of the regulators. These values are given as integers (i.e., whole numbers) to simplify the presentation. To be more accurate, and bring the work scores into agreement with the original data, just divide each value by 100. The units, then, are in terms of kilogram-meter per liter. Hence, a work score of 22 corresponds to 0.22 kilogram-meter per liter — the work that must be exerted for each liter of air consumed in the breathing cycle under the test conditions cited. Although every effort was made to maintain accuracy in determining the work scores in the table, some error may have been made by the author in reading the values of points on the graphs. This error should be no more than ± 1 unit in the tabulated numbers, however.



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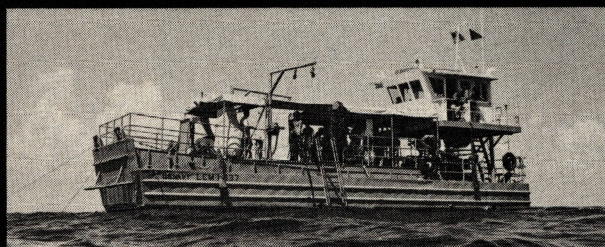
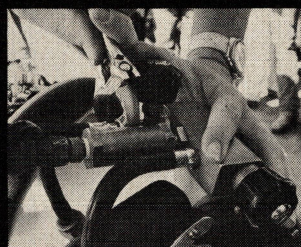
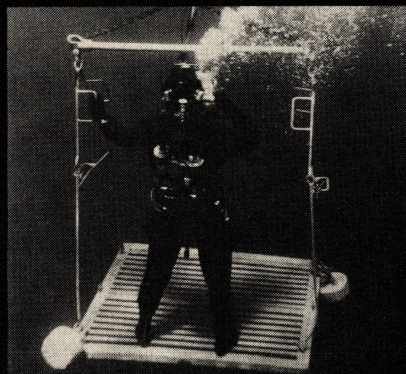
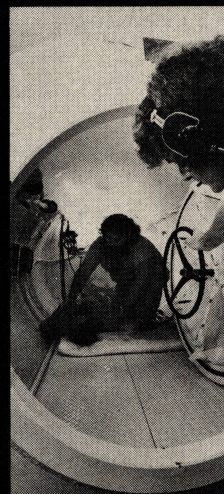
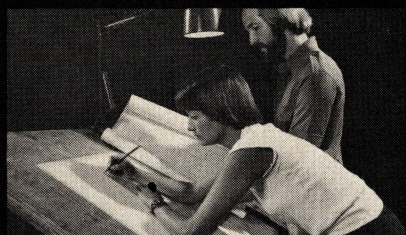
(Continued from Page 20)

breed. Humpbacks breed in warm waters and feed in cold, and in the warmer portions of their Atlantic and Pacific ranges they are often beset by whale watchers, especially in Hawaii. An additional problem faces the Atlantic population, which migrates from the cold-water feeding grounds of Greenland and Newfoundland to the warmer waters of the Caribbean. In Canadian waters, these whales often become entangled in the cod traps of Newfoundland fishermen, and they can drown in these traps, often destroying the valuable nets in their struggles. There are a number of cetologists in Newfoundland who have attempted to rescue the whales from the nets, but they cannot be everywhere at once, and in recent years a number of whales have died. As a possible solution, it has been suggested (by the fishermen) that the Canadian government resume whaling, particularly to rid Newfoundland's waters of the troublesome humpbacks. The government has repeatedly denied that there are any plans to resume commercial whaling, but they do not rule out the possibility of killing the whales to protect the fishing industry, which happens to be Newfoundland's most important source of revenue.

It is possible, now that large-scale whaling activities have been curtailed, that a singular threat to the whales would come from those who would protect them. Even though their intentions are totally benign, the whale watchers, by their very numbers and enthusiasm, may have a negative effect on the whales they love. Every whale watcher understands this, he wants to see the whales up close, but he also knows that too many of him will be harmful to the whale populations. Who will decide who can go and who cannot? Who will tell the environmentalists, the museums and the whale conservation groups that their well-intentioned (and highly remunerative) trips — to Baja, to Hawaii, to Provincetown, to Newfoundland — may actually be harming the whales?

One place where there are no whale watching trips — so far — is Patagonia. The right whales of Peninsula Valdes have been celebrated in print and in film. The whales come here every year to breed, and they represent the largest known population of one of the world's rarest mammals. Wherever whalers invaded the breeding grounds of right whales, those whales that were not killed inshore deserted these areas, and have not returned. The first right whalers were the Basques, who hunted off the coasts

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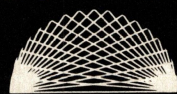


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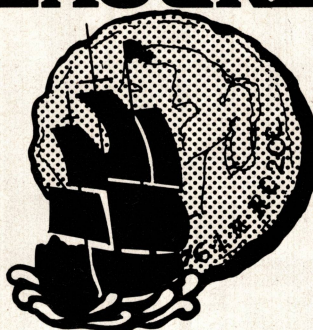


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POLITICS OF WHALING

of Spain and France as early as the 11th century. Those whales that were not killed were driven away, and there have been no right whales in European waters for centuries. The same thing happened off Cape Cod, and the waters of Japan, Australia and South Africa. Only the Patagonia right whales, which come to the remote gulfs of Valdes, have remained unmolested through the years. Will the publicity received by these whales result in an invasion of their protected waters? Before one answers too quickly that Patagonia is too far away, too difficult to get to, and too chancey as far as weather is concerned, bear this in mind: In November, 1979 an American Sportsman television crew went there and filmed marathon swimmer Diana Nyad swimming with the whales. According to ABC-TV, this show was seen by 20 million people, and a fair number of them probably thought that Patagonia would make a pretty good dive trip. Fortunately for the whales, the Argentine government fiercely protects this national treasure, so whale watching trips to Patagonia seem to be unlikely in the near future.

Most of us are familiar with the controversy surrounding the bowhead whale in the western Arctic: The Eskimos want to kill a number of them every year in order to maintain their cultural heritage, and the preservationists claim that there are too few bowheads to allow any killing at all. It was not always so. In the 17th and 18th centuries, the Dutch and the English hunted the Greenland right whale (now known as the bowhead) in the eastern Arctic off Greenland, Spitsbergen, and Jan Mayen Land. So effective was their hunting that the species was completely eliminated from the eastern Arctic, and the 2500 bowheads in Alaskan waters represent the only bulwark between this animal and total extinction.

The Eskimos probably could not kill 2500 bowheads, but modern technology certainly could. Along the North Slope of Alaska, the oil companies are prospecting for oil, and their exploratory drilling has taken place immediately in the whales' migration routes and feeding area. The sale of oil leases in this area has been temporarily blocked by federal court order, but this decision is currently under appeal. A similar situation exists in Baja California: The Mexican government is currently investigating the possibilities of drilling for oil in the Vizcaino Desert, immediately east of Scammon's and Guerrero Negro Lagoon. The actual drilling operations are bound to disturb the whales, and an oil spill or a blowout would be a disaster. One hardly needs to be reminded of the Ixtoc well in the Gulf

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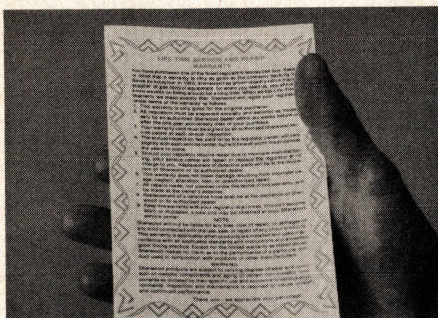
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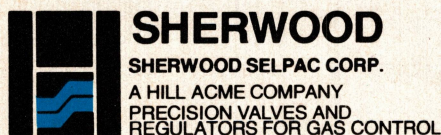
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of Mexico that spewed millions of gallons of burning oil into the water to envisage the detrimental effects that such an event would have on the whales. The potential destruction of the whales' habitat is probably the most insidious of all threats to the future of the whales. If we can actually destroy a part of the ocean so that whales and other creatures cannot live there, then no place on earth is safe from man's destruction.

Next to a whale, a man is an insignificant creature. But through his technology, he is able to conquer even the greatest of the leviathans, and reduce the once living body to canned meat, pet food, margarine, lipstick, boot polish and fertilizer. The whales were probably doomed from the start, not only because they represented meat, oil, and other products, but also because they were the largest manifestations of creation, and therefore to be subdued. There is no known animal on Earth, from the smallest mite to the various orders of amphibians, reptiles, birds and mammals that we have not killed at one time or another. Consider the whale: A hundred tons of meat and oil, waiting to be plucked from the sea like some gigantic coconut. And like the coconut, it grows wild; you don't even have to plant or fertilize it. Looking at the long and bloody history of whaling, the wonder is not that we killed the whales; that was to be expected. The wonder is that we didn't kill them all.

It is now our responsibility to allow the remaining whales to live peacefully, and to expiate our sins by not destroying them altogether. We must not destroy their habitat, nor must we love them to distraction. The story of whales and men has often been likened to a war epic, but this cannot be correct for only one side is armed. The other asks no more than to be left alone. Whales harm no one, and they benefit mankind by the simple and glorious fact of their existence. The only threat they would seem to pose is to those who arrogantly desire to demonstrate mankind's supremacy over all other forms of life. It is a measure of our rampant insensitivity that the question can even be asked: Can we *allow* the whales to survive? Will we ever come to understand the honor of sharing our lives with the greatest creatures ever to inhabit this planet?

The International Whaling Commission concluded its 32nd Annual Meeting on July 26th, in Brighton, England. It was a meeting marked by controversy and bitter infighting, but when the dust had cleared, some small gains were registered by the whales. The IWC is concerned primarily with large cetaceans —

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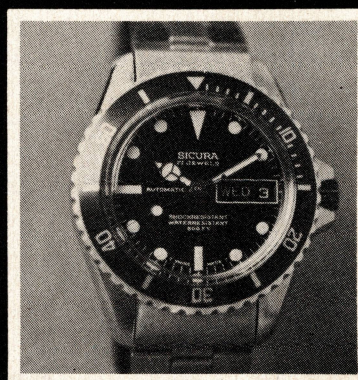
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POLITICS OF WHALING

although there was some spirited discussion on exactly what is and what is not a whale — and most of the commission's business is directed toward large whales and whaling. There is no hunting at all of blue and right whales (although pirate whalers will kill any whale of any species), and limited catches of fin, sei, and Bryde's whales. Humpbacks and grays are taken in small numbers for aboriginal "subsistence" fisheries, primarily by the Soviets (179 gray whales for Siberian Eskimos), and the Greenlanders and Faroe Islanders, who, under Danish rule but more or less autonomous, take ten humpbacks and ten fin whales annually.

One of the most controversial issues at this and previous IWC meetings has been the Alaskan Eskimo's hunting of the bowhead whale. The Eskimos claim that the bowhead is not only necessary for their nutritional needs, but also serves as a focal point of their culture: The spring hunt of bowheads is the most important single event in the Eskimo's calendar. The conservationists (supported by the findings of the IWC's Scientific Committee), maintain that the Bering Sea population of bowheads, estimated to be around 2300 animals, is the most seriously threatened of all the world's large whales, and nothing short of a zero quota will do. As usual, compromise was the order of the day, and while the world watched the U.S. delegation try to appease both the Eskimos and the conservationists, the IWC's Chairman, Thordur Asgeirsson of Iceland, proposed a three year block quota of 45 whales landed and 65 struck, with no more than 17 whales landed in any one year. This resolution was passed, and represents a somewhat lower quota than last year, (18 landed and 26 struck), and demonstrates that the U.S. policy is, as stated by its IWC Commissioner Richard Frank, to gradually reduce the bowhead kill as more information becomes available on its declining population.

Also on this year's agenda was a total moratorium on all commercial whaling (defeated), and a moratorium on the killing of sperm whales (also defeated). For 1980/81 the cold harpoon was prohibited for all whaling except minke whaling, but an Australian amendment was carried whereby this device, which has no explosives and therefore kills the whale slowly, would be totally eliminated from all whaling by 1981/82.

The whaling nations of the world lined up solidly against the non-whalers, and were thereby able to achieve a mandate for the continuation of their activities. It is

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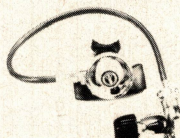
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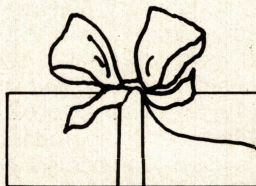


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POLITICS OF WHALING

not only the Japanese and the Russians who kill whales for profit — although they are the only countries with factory ships and catcher boats — but voting with them on most pro-whaling issues were Spain, South Korea, Peru, Chile, Brazil, Iceland and Norway, more than enough to block the two-thirds that would be required to pass the moratorium resolutions. Even though the quotas were reduced from last year's, almost 14,000 whales will be killed by whalers in 1980/81. Most of these will be minke, with a total of 6718 for the Antarctic, and another 3915 in the North Pacific and the North Atlantic. After the failure of the sperm whale moratorium, the Japanese asked for a quota of 1350 sperm whales for their coastal fishery (pelagic sperm whaling was banned at last year's meeting), but after a confused and confusing discussion, a compromise was finally reached at 2:00 am. The quota for the western North Pacific is now 890 sperm whales, with size restrictions imposed by an Australian amendment.

Two new nations joined the IWC this year (Oman and Switzerland), and Panama dropped out, bringing the total of voting nations to 24. The Taiwanese delegation was denied admittance to the meetings, but on the last day a group of observers appeared from the People's Republic of China. It was as much a meeting about international politics and negotiations as it was about whales and whaling.

Richard Ellis, whose paintings of sharks, whales, and fishes are well-known to divers, was a member of the U.S. Delegation to the International Whaling Commission in July, 1980. His comprehensive Book of Whales will be published by Knopf this month.

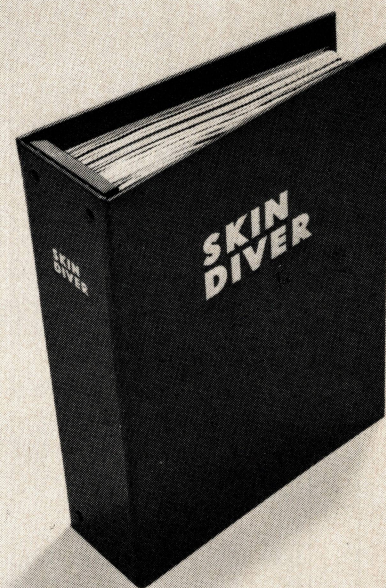
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TECHNIFACTS

(Continued from Page 64)

structures but one system, for shallow water, has a chain riser. The other model, for deep water installation, has a large diameter articulated riser shaft. In the case of the unit with the riser chain, the float-sink hoses comes off a hose arm at the base. In the unit with the riser shaft, the hose string comes off a hose arm at the top of the riser shaft.

In the tower system (STM) the hoses come off a manifold at the top of the tower, which in turn is connected to the submarine pipeline via a pipe running up the tower from the base.

As far as I know, only one articulated loading column (ALC) is being built at present. It is designed to handle crude oil in nearly 400 feet of water. It is quite similar to a deep water SALM unit, with the riser column of the ALC being much larger and made of concrete rather than steel.

Also one-of-a-kind at present is the ELSBM unit in the North Sea. In general design it appears similar to the CALM units, but the entire unit is much larger. This huge structure is in two parts — the

basic hull is 39 feet in diameter by 135 feet in height, topped off with a superstructure 72 feet in diameter by 50 feet high. The unit contains living quarters for the operators, and a heliport on top of what is probably the largest mooring buoy in the world.

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Ancillary equipment will include marine hoses, hose pickup buoys and chains, valves and fittings to control flow of product, and, usually, navigational aids to delineate the extent of the mooring and to assist the operators of the terminal in getting the vessels into the mooring.

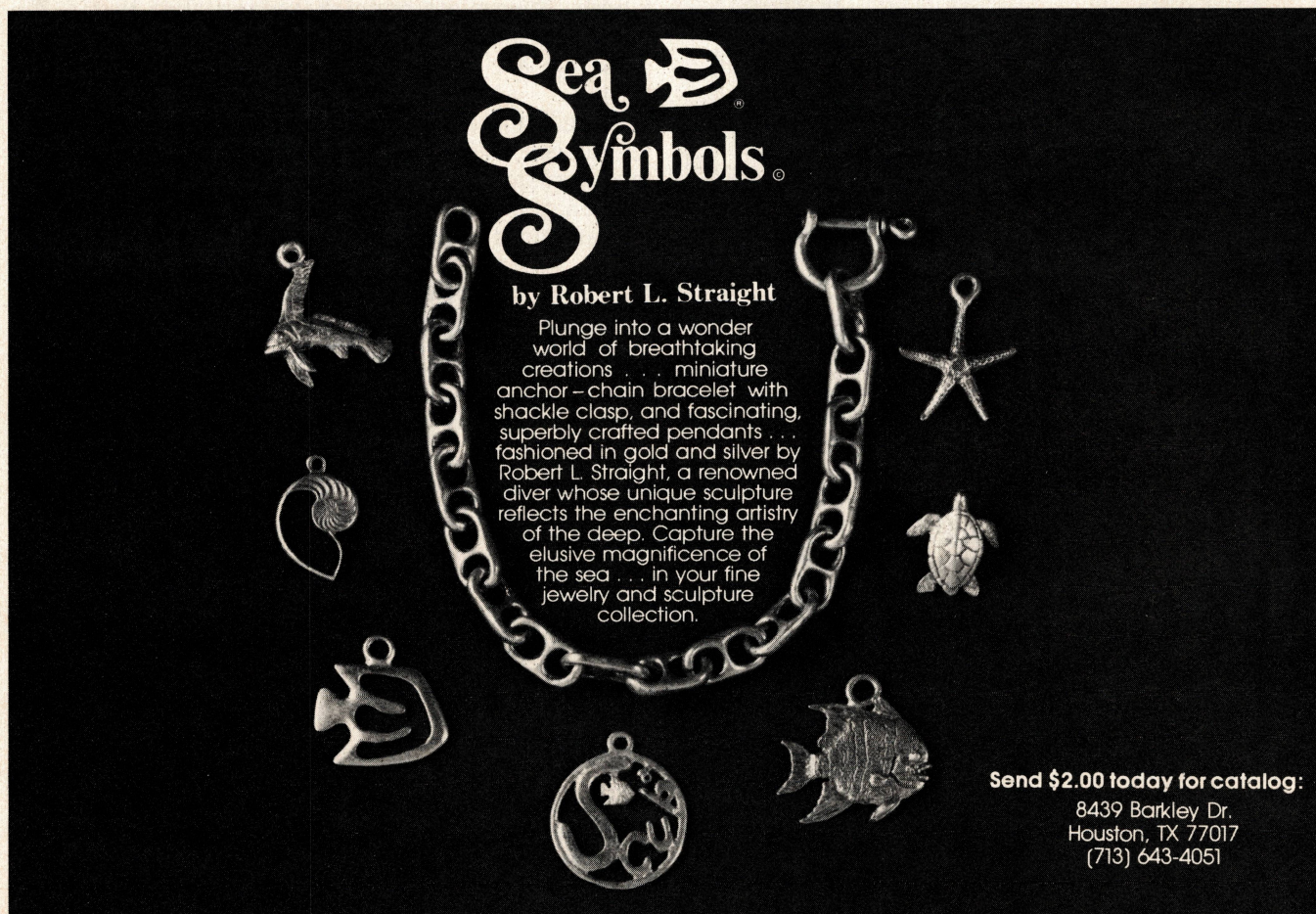
THE WORK OF THE DIVER

Some operators of offshore mooring systems keep divers at the mooring whenever a vessel is in, and nearly all operators require monthly inspections of some sections of the terminal. Many operators have found it is to their advantage to retain the services of the same diver, or dive company, to perform scheduled inspection and maintenance of their installations. The primary reason for this is that the divers will develop a more complete working knowledge about the installation, the ships using the mooring, the environmental characteristics affecting the installation, and the special interaction among all these elements.

The diver-inspector should pay particular attention to all failure-prone ancillary equipment such as shackles, hoses, pickup buoys and valve parts. The diver should carry short lengths of wire with him to permit installation of safety wires on the smaller shackles or fittings that may need securing. Hose pickup buoys and chains must also be maintained in good condition.

Some corrosion problems are usually present in MBM systems, but as far as I know there have been no attempts to design a cathodic protection system to eliminate or mitigate such corrosion in MBM systems. (The U.S. Navy has been able to complete successful cathodic protection of their two-buoy moorings.) Zincs could be attached to buoys but modern marine coatings protect against corrosion almost as well. Most large mooring systems such as SALM, ALC and STM's have cathodic protection systems. Details of these systems will be covered in a later Technifacts.

In construction of a MBM system, diver assistance is sometimes required in placing the anchors and in making a final inspection. Chains leading to the mooring anchors of a MBM are attached to the bottom padeye of the buoy by a special bending shackle employing a large shackle pin and a forelock key and ring to hold the pin in place, or by a detachable link. These are much more secure than



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conventional screw pin shackles, but do require periodic inspections and occasional replacement of the forelock key and retainer ring. The diver-inspector should also check the buoy carefully for damage and for corrosion problems.

The chain leading from the buoy to the anchor may be one length of chain or several shots of 15 fathoms each. When the latter, each shot will be connected by a patented connecting link (in newer systems) or by a special connecting shackle (in older systems). In both methods a tapered pin holds the assemblies together and the pin is held in place by a lead plug. Perhaps once each year, in making dozens of inspections of mooring system anchor chains, I have found the lead out of the connecting link and the pin either loose or partly out. Usually this is a link close to, or in, the dip section of the chain. It is an easy task for the diver to drive the pin home and replace the lead plug in the recess over the head of the pin.

The size of anchor chain chosen for MBM use is such that two to three years' service may be expected before wear in the dip section of the chain becomes a potential problem. The dip section is that part of the chain that bangs up and down on the ocean bottom with the passing of each wave, causing considerable wear in the chain links. After two to three years of use it is advisable to measure the chain links in the dip section to determine if the chain still meets ABS specifications. A diver can measure the dip section by using a float bag to raise the dip section off the bottom to eliminate the violent action of the chain caused by the waves. A single, large float bag is preferable to several smaller floats. The float bag I use lifts a maximum of five tons and sometimes has a load of three tons during a lift to measure deep water dips. This allows a good safety factor.

Use large calipers to measure the diameter of the double links and the diameter of the side of each link. Use underwater slates to record measurements. Or use a band mask or lightweight helmet equipment equipped with topside communication equipment. An operator topside can log inspection findings. It is also a good idea to prepare a special form for recording and reporting this information. Some operators assign engineers to the dive platform during such inspections to permit evaluation of findings and safety of the chain.

The mean diameter of one of the double links is one-half the double diameter plus the side diameter of the link divided by two. As an example, suppose the chain was originally a three inch diameter chain. A double link of a new three inch chain would measure six inches. However, when measured after two years of service, the double diameter of the links in the dip section could be reduced by wear to five and one-half inches. The side diameter of the links

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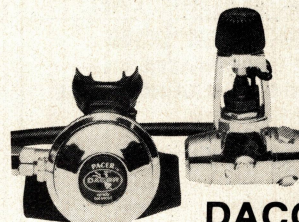
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being measured would be two and fifteen-sixteenth inches. The mean diameter would then be one-half of five and one-half inches, or two and three-quarter inches plus two and thirteen-sixteenth inches, or five and eleven-sixteenth inches divided by two equals two and thirteen-sixteenth inches mean diameter. This is one-eighth inch larger than minimum ABS safety requirements for a chain of that size. However, the rate of wear to this mean diameter indicates the dip section of this particular chain will have to be replaced within the following year.

All SPM's, except possibly the ELSBM system, utilize the services of divers during installation and, in most units, in connection with routine inspection and maintenance. Diver requirements during construction of SALM and ALC units are in connection with anchor base placement, in operating flooding valves and in making the final underwater connection to the base and to the risers.

The principle inspection and maintenance problems with the CALM units involve the underbody of the buoys, the chains, and the hoses; with the first hose off the buoy taking most of the wear and requiring the most frequent replacement. All units require diver inspection for damage by vessels; of hoses and mooring equipment; for removal of excess marine growth; for cleaning the hull and fittings; for corrosion problems; to make cathodic protection (CP) surveys; and to upgrade the CP system as required. Also, divers are required to keep the area around the base and hoses clear of debris, such as sharp metal and other objects that can foul the system or cut the hoses. Since many of these units are designed for installation in very deep water, divers performing inspection and maintenance would utilize mixed gas diving units, one atmosphere units such as JIM rigs, or submersible units for some of the work. In most cases communication with the surface would be desirable.

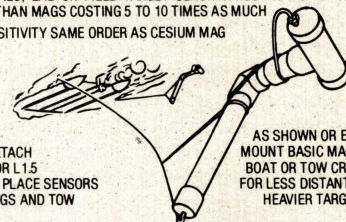
In the past two years or so, dive contractors feared that manned submersible or remote control vehicles might supplant divers in inspection and other traditional diver work. At present there are about 100 manned submersibles in operation and more than a dozen remote controlled vehicles. These versatile craft/devices have found application in some areas of inspection, maintenance, retrieval and debris clearance. However, the offshore industry has recently found that these devices, combined with the capabilities of divers, provide a team that can, in many areas of work, outperform the work of either acting singly.

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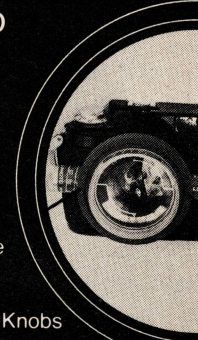


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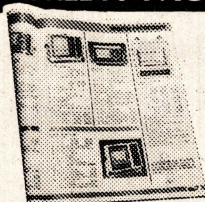
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To aid divers in developing a working knowledge as quickly as possible and so that meaningful and helpful reports may be submitted, the following suggestions are offered:

1) Make a complete inspection of the system whenever a new ship occupies the mooring. Each vessel, or class of vessel, will affect the mooring and all ancillary equipment to a different degree. In a MBM system, hoses will lead up to the ship's manifold at a different angle. Mooring lines, particularly the heavy wire ropes frequently used, will drag across the underwater part of the system at different places, thus affecting different underwater installations.

2) When the same vessel calls at the mooring repeatedly, schedule the diver inspections alternately when the vessel is in the moor and when the moor is not occupied. This permits inspections of components of the mooring under different conditions and will result in a better analysis of developing problems.

3) During an inspection when a vessel is in the mooring, check for the lead of the submarine hoses. More kinked and damaged hoses are the result of poor leads than any other reason. Discuss hose positions and leads with the mooring master so he can reposition the vessel to eliminate potential problems. Also, check each vessel for hose lead across

tanker bilge keel. This is particularly applicable to MBM's, but may apply to SBM's in some cases.

4) Schedule an inspection occasionally, when water clarity permits safe and meaningful observation, to observe hose lay down procedures. If visibility is poor, make an inspection immediately after the vessel clears the mooring to observe hose and system condition. Hoses laid down with loops can result in severe kinks when that hose is pulled out or when next picked up. Hoses laid one on top of the other, in multi-hose systems, can lead to kinks and hose damage.

5) Schedule an inspection to observe hose action underwater during pickup by the vessel. Again, provided water clarity permits safe observation. In MBM's a tug is usually used to pull the end of the hose around so the ship's gear can hook into the pickup chain and raise it to the deck connection on the ship's manifold. During this procedure, observe the action of the hose with respect to kinking and bending. It has been found that application of moderate (75 psi or so) pressure on the hose string during any pulling of the hose will eliminate risk of kinked hoses. This pressure must of course be applied by the onshore facility but the diver can check the results obtained by pressuring hoses in a particular mooring system.

6) Learn all there is to know about the facility to be inspected, its design, problems that have developed, and about the vessels that use the system. Work out a tentative inspection schedule to cover all contingencies that might develop. Then discuss this schedule with both the operators of the terminal and the mooring master(s) who actually work the offshore terminal. It is particularly important that good working relations exist between the diver-inspector and the mooring master who handles the vessels using the mooring. He will know best the specific problems of the mooring.

7) Always have a means of recording inspection data, either by using underwater notes (slates or paper made specially for writing underwater — called Ascott) or by communications with topside personnel via diver telephone. Make sketches, take underwater pictures when possible, keep good records, make good, clear, concise reports, and then analyze the information to determine the patterns of wear or maintenance requirements.

Perhaps the best advice to a diver-inspector is to be totally aware at all times of everything involved with the offshore mooring you are employed to inspect and maintain. Study reports of other moorings in trade publications and the problems and methods to overcome

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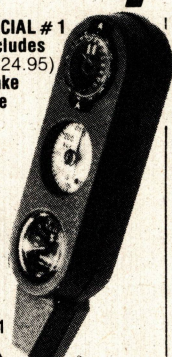
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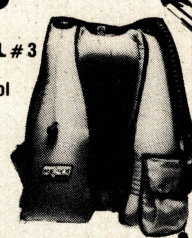
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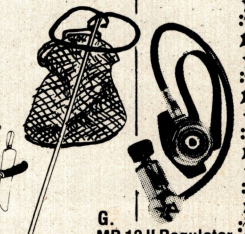


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those problems. See how these methods can be applied to conditions in the mooring you are working on. Whenever possible, take photographs of the installation both when new and as wear progresses to permit better evaluation of conditions. Keep in mind that there is now a camera housing for the SX-70 Polaroid camera that permits rapid inspection of underwater pictures.

Finally, keep the owner-operators advised via written reports of all your findings, both from inspections and from the study of reports of other moorings. The longer a diver keeps a mooring system, regardless of type, in good operating condition, the longer he has a job.

Readers involved with mooring inspections may write to E. R. Cross, Technifacts, % SKIN DIVER Magazine, 8490 Sunset Blvd., Los Angeles, CA 90069, for copies of the following:

- Buoy inspection forms that may serve as useful guides in developing report forms for a specific mooring.
- A copy of ABS and Lloyds table of sizes for replacing worn anchor and mooring chains.
- A source for Ascott underwater paper.

Send a legal size, self-addressed and stamped envelope (28 cents postage) for this data.

Rx FOR DIVERS

(Continued from Page 32)

often confused with toothache.

Question: Chad Eyanson of El Paso, Texas has earned emergency medical technician and Red Cross water safety instructor ratings. Next on his list is scuba diving, but he has misgivings. He's allergic to Bermuda grass, a common groundcover in his area, and this interferes with ear clearing. Chlortrimeton, an antihistamine, gives some relief but his pulse goes up 10 to 12 beats per minute. Dimetapp, an antihistamine-decongestant combination, works better but gives him a headache. Rondec, another such combination, works best but seems to overstimulate his nervous system. Are these side effects safe underwater? Chad also complains that diving manuals don't provide enough information about dive medicine, and requests more advanced references.

Answer: Pills divers take to help clear their ears are antihistamines, decongestants, or combinations of both. Antihistamines, in their side effects, tend to mimic atropine. They can raise the heart rate by blocking the vagus nerve, which normally acts to slow it — like taking off the



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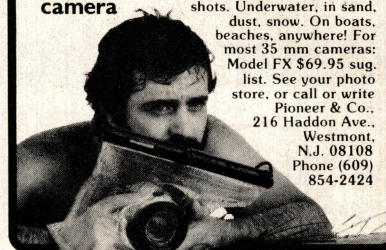
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brakes. They may also cause drowsiness, dry mouth, and blurred vision. Decongestants, on the other hand, can raise the heart rate by direct stimulation, as well as make a person feel nervous and jumpy.

Any medicine that changes the way a diver feels or interferes with normal heart regulation introduces potential hazards. However, individual tolerance varies tremendously, and some divers report no untoward effects from the pills mentioned. For Chad we suggest using a nasal spray instead of pills, consulting a diving instructor about techniques of ear clearing, and if still troubled, seeing an ENT specialist.

As to references, the medical section in *The New Science of Skin and Scuba Diving* is excellent but necessarily brief. More extensive treatments are found in Chris Dueker's new book, *Scuba Diving Safety*, World Publications (intended for instructors and sophisticated divers), and in *Diving Medicine*, Richard Strauss, editor, Grune & Stratton (intended for physicians).

Question: Can dialysis patients dive?

Larry Wilson of San Francisco used to dive for the Navy and now wants to dive for himself. Because his kidneys don't work, he wears a little tube inserted through the abdominal wall into his peritoneal cavity. At intervals, he runs a special fluid into the peritoneum, waits for it to absorb wastes from the blood, and then drains it out. He wonders whether pressure could break the seal between tube and skin, and force sea water into his abdomen.

Answer: Although there's no gas in the peritoneal cavity, there usually is some in the intestine, so diving does create an inward pressure gradient. However, the flexible abdominal wall moves inward as gas volume contracts, and there's no reason to suppose that sea water would be forced in around the dialysis tube. If you wear a wetsuit, the tube should be protected against any sliding movements of the suit which would push or tug on it.

Question: Dr. David Machtel of Lansing Community College, Lansing, Michigan has thoroughly enjoyed diving for 30 years. Now he has a problem with his eyesight, and is scheduled to have his right lens removed and replaced with a better synthetic one. He wonders, of course, whether this will put a stop to his diving.

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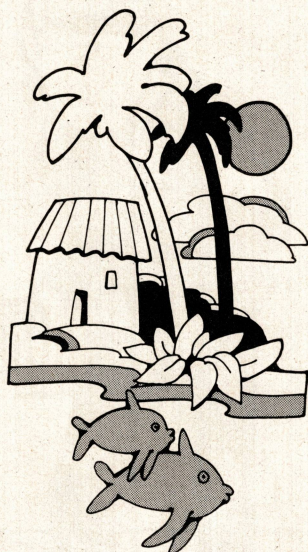
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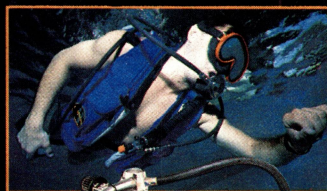
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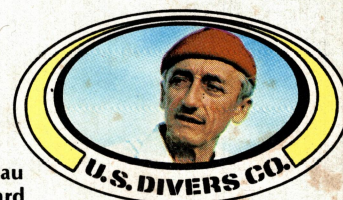
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